Project Manual for the Construction of:

CAESAR CREEK STATE PARK

THE MARINA AT CAESAR CREEK

WARREN COUNTY, OHIO
DNR-130053

RE-BID PHASES 1A & 1B

ENGINEERING
Ohio Department of Natural Resources

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENGINEERING
2045 MORSE ROAD, BUILDING E-3
COLUMBUS, OHIO 43229-6693
(614) 265-6948

BID DATE: **Tuesday, December 16, 2014**

DATE OF ADDENDUM: **Thursday, December 4, 2014**

ADDENDUM NUMBER: **1**

TO THE DRAWINGS AND SPECIFICATIONS FOR:

Caesar Creek State Park
The Marina at Caesar Creek
Warren County, Ohio
Project Number DNR - 130053

TO ALL BIDDERS:

THIS ADDENDUM, MODIFYING THE ORIGINAL CONTRACT DRAWINGS AND SPECIFICATIONS, SHALL BE TAKEN INTO ACCOUNT IN PREPARING PROPOSALS, AND IS HEREBY MADE A PART OF THE CONTRACT DOCUMENTS.

DRAWINGS

1. Drawings C-408, C-409, and C-410 were inadvertently left out of the original posted set of files. The missing drawings dated November 21, 2014, are attached.

QUESTIONS AND ANSWERS

1. **Question:** Is a printable list of the bid items available?

   Response: Attached as a pdf, for reference only, is a list of bid items. This attachment is not the official bid schedule.

END OF ADDENDUM

Hung Thai, P.E., Chief Engineer
Ohio Department of Natural Resources
Division of Engineering

Attachments: Phase 1B drawings C-408, C409, C-410
List of Bid Items

Caesar Creek State Park
The Marina at Caesar Creek
Warren County, Ohio
Project No. DNR-130053

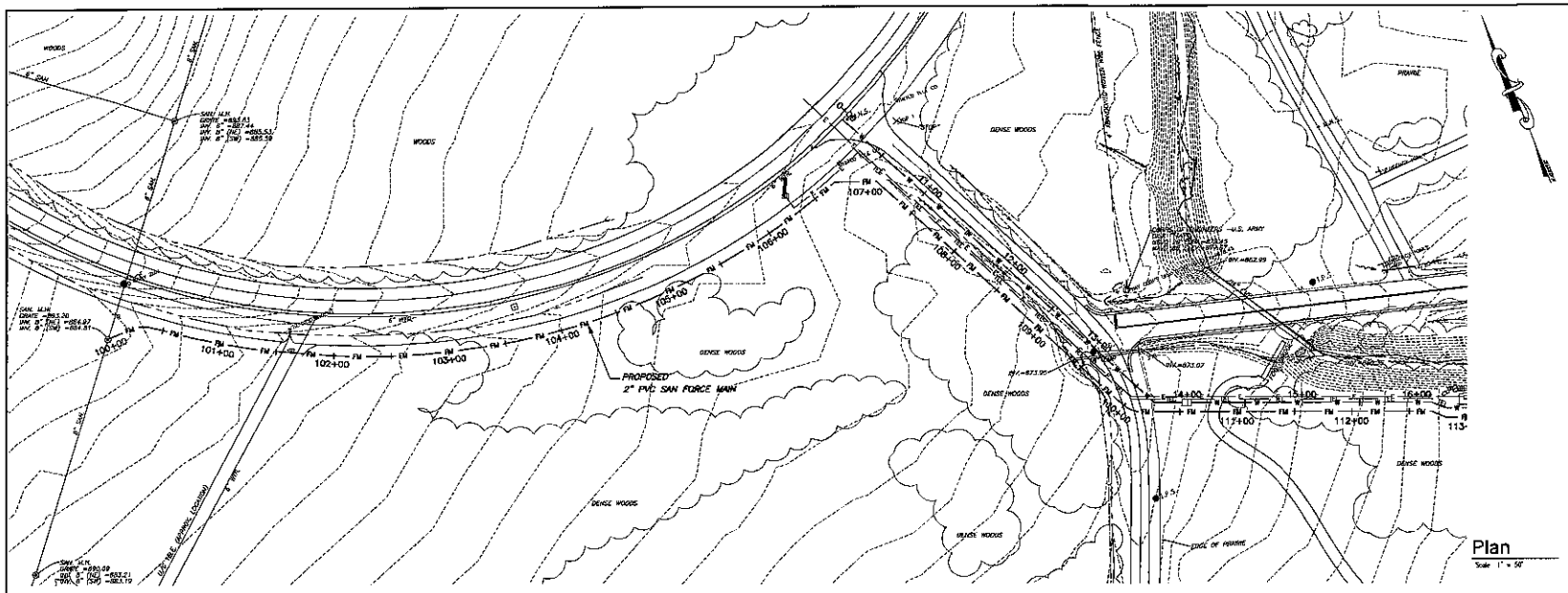
CONTRACT 1 - GENERAL

ITEM NO.	DESCRIPTION	LABOR	MATERIALS	QUANTITY	UNIT	ITEM TOTAL
	ALLOWANCES					
1	Testing Lab					$ 30,000.00
2	Floating Marina Services Building Buildout					$ 50,000.00
3	Electric Work by Utility					$ 8,000.00
	LUMP SUM					
4	Mobilization & Demobilization			1	LS	$ -
5	Site Preparation			1	LS	$ -
6	Erosion Control			1	LS	$ -
7	Site Earthwork -Upland			1	LS	$ -
8	Site Earthwork -Basin			1	LS	$ -
9	Stream Realignments(ET1 and ET2)			1	LS	$ -
10	Weir Control Structure			1	LS	$ -
11	Floating Marina Services Building			1	LS	$ -
12	Fuel Attendant Building			1	LS	$ -
13	Marina Fueling System			1	LS	$ -
14	Sanitary Sewage Grinder Pump			1	LS	$ -
15	Timber Bridge - Youth Pond			1	LS	$ -
16	Marina Sanitary Pump Out System			1	LS	$ -
17	Signage - Dock Signage			1	LS	$ -
18	Dockage - Floating Attenuator			1	LS	$ -
19	Dock Anchorage - Attenuator			1	LS	$ -
20	Dock Anchorage - Marina Docks			1	LS	$ -
21	Main Landside Connection			1	LS	$ -
22	Reconnection of Existing Connection to Patrol Boat			1	LS	$ -
23	Electrical – Site and Dockage			1	LS	$ -
24	Retaining Wall at Transformer Pad			1	LS	$ -
25	Pavement Markings			1	LS	$ -
26	Signage – Traffic/Road Regulatory			1	LS	$ -
27	Signage – Park Entry Sign			1	LS	$ -
28	Signage – Marina Drop Off Sign			1	LS	$ -
29	Stream Culvert Crossing			1	LS	$ -
30	1-Year Maintenance – Upland and Wetland Seed Areas			1	LS	$ -
31	1-Year Maintenance – All Plant Materials			1	LS	$ -
32	Temporary Irrigation System			1	LS	$ -
	UNIT PRICE					
33	Strip and Stockpile Topsoil			8,500	CY	$ -
34	Salvaged Topsoil Placed			8,500	CY	$ -
35	Topsoil Furnished and Placed			1,000	CY	$ -
36	48" RCP Storm Pipe Extension			48	LF	$ -
37	42" RCP Storm Pipe Extension			34	LF	$ -
38	Filter Fabric for Revetment			2,860	SY	$ -
39	Bedding Stone for Revetment			1,500	TON	$ -
40	Riprap Stone for Revetment			3,000	TON	$ -
41	Stacked Stone Block			135	TON	$ -
42	Salvaged Rubble Mound Fish Habitat			24	EA	$ -
43	Habitat Log Placement			51	EA	$ -
44	Pavement and Subgrade Repair			1,300	SY	$ -
45	Asphalt Pavement - 4.5"			825	CY	$ -
46	Crushed Aggregate Base Course			5,620	TON	$ -
47	Compacted Fill			12,000	CY	$ -
48	Concrete Curb and Gutter - Standard			2,050	LF	$ -
49	Concrete Landscape Curb			90	LF	$ -
50	Path - Gravel			1,500	SF	$ -
51	Path - Concrete (Sidewalk)			6,100	SF	$ -
52	Detectable Warning Fields			4	EA	$ -
53	Concrete Wheel Stops			8	EA	$ -
54	Dockage - Head Piers and Slips			26,440	SF	$ -
55	Dock Lights - Solar			42	EA	$ -
56	Access Control Gates (Dockage)			3	EA	$ -
57	Access Control Fencing (Dockage)			60	LF	$ -

Exhibit for Reference Only

ITEM NO.	DESCRIPTION	LABOR	MATERIALS	QUANTITY	UNIT	ITEM TOTAL
58	Dock Ladders			50	EA	$ -
59	Fire Extinguisher Cabinet - Unlit			11	EA	$ -
60	Fire Extinguisher Cabinet - Lit			9	EA	$ -
61	Fire Protection Staging Areas			9	EA	$ -
62	Single Slip Dock Utility Center			6	EA	$ -
63	Dual Slip Dock Utility Center			29	EA	$ -
64	Navigation Aid Lights			1	EA	$ -
65	RCP - 12-inch			410	LF	$ -
66	Perforated - PVC - 6-inch			630	LF	$ -
67	Curb Inlet w/ Grate			1	EA	$ -
68	Catch Basin Structure w/ Grate			4	EA	$ -
69	RCP - Apron Endwall w/ Grate and Concrete Cutoff Wall			2	EA	$ -
70	6-inch Waterline			1,225	LF	$ -
71	4-inch Domestic Water Main			100	LF	$ -
72	2-inch Sanitary Force main			2,410	LF	$ -
73	Sanitary Force Main Connection			1	EA	$ -
74	Fire Hydrant Assembly			2	EA	$ -
75	6-inch Gate Valve and Fittings			3	EA	$ -
76	Water Main Connection			1	EA	$ -
77	Water Main - Vault			1	EA	$ -
78	Plumbing - CPVC Piping			1,260	LF	$ -
79	Plumbing - DUC Connections			35	EA	$ -
80	Plumbing -Flexible Connections at Gangways			8	EA	$ -
81	Fire Protection - Dry Line 4" Piping on Docks			1,940	EA	$ -
82	Fire Protection - Dry Line 4" Piping on Land			180	EA	$ -
83	Fire Protection - Dry Hydrants			9	EA	$ -
84	Fire Protection -Dry Standpipe Connection and Bollards			1	EA	$ -
85	Seed Mix - Emergent			0.65	Acre	$ -
86	Seed Mix - Savannah			0.27	Acre	$ -
87	Seed Mix - Wet Prairie			0.77	Acre	$ -
88	Seed Mix - Prairie			5.40	Acre	$ -
89	Seed Mix - Turf Grass			3,615	SY	$ -
90	Seed Mix - ODOT			16,970	SY	$ -
91	Seed Mix - Biofiltration			1,445	SY	$ -
92	Soil - Biofiltration			605	CY	$ -
93	Stone - Biofiltration (Cobble Stone Mulch)			2,500	SF	$ -
94	Emergent Wetland Plugs			12,749	EA	$ -
95	Deciduous Trees - 2-1/2" Cal. Root Bag			8	EA	$ -
96	Deciduous Trees - 2" Cal. B&B			31	EA	$ -
97	Deciduous Trees - 1" to 1-1/2" Cal. Cont.			5	EA	$ -
98	Deciduous Trees - 5' Clump B&B			4	EA	$ -
99	Deciduous Shrubs - #5 Cont.			48	EA	$ -
100	Deciduous Shrubs - #3 Cont.			99	EA	$ -
101	Perennials & Grasses - #1 Container			60	EA	$ -
102	Perennials & Grasses - Perennial Plugs, 2" Dia. Round Tapered Plugs			65	EA	$ -
103	Restoration-Grade Plant Material, 1-2' to 2-3' Ht Bare Root			1,016	EA	$ -
104	Erosion Mat - Slope Erosion Control Mat			6,624	SY	$ -
105	Erosion Mat - Channel Erosion Control Mat			1,800	SY	$ -
106	Herbicide Application for Native Seed Preparation			0.30	AC	$ -
A.1	Wave Attenuator with Public Access			1	LS	$ -
A.2	Form Liner for Architectural Concrete			1	LS	$ -
A.3	Concrete Paver Dock Surface (except fuel dock, fillets, transformer pads, and fire staging areas)			22,600	SF	$ -
A.4	Composite Decking Dock Surface (except fuel dock)			22,600	SF	$ -
A.5	Contech Express Pedestrian Truss Bridge (10'x30')			1	LS	$ -

Exhibit for Reference Only

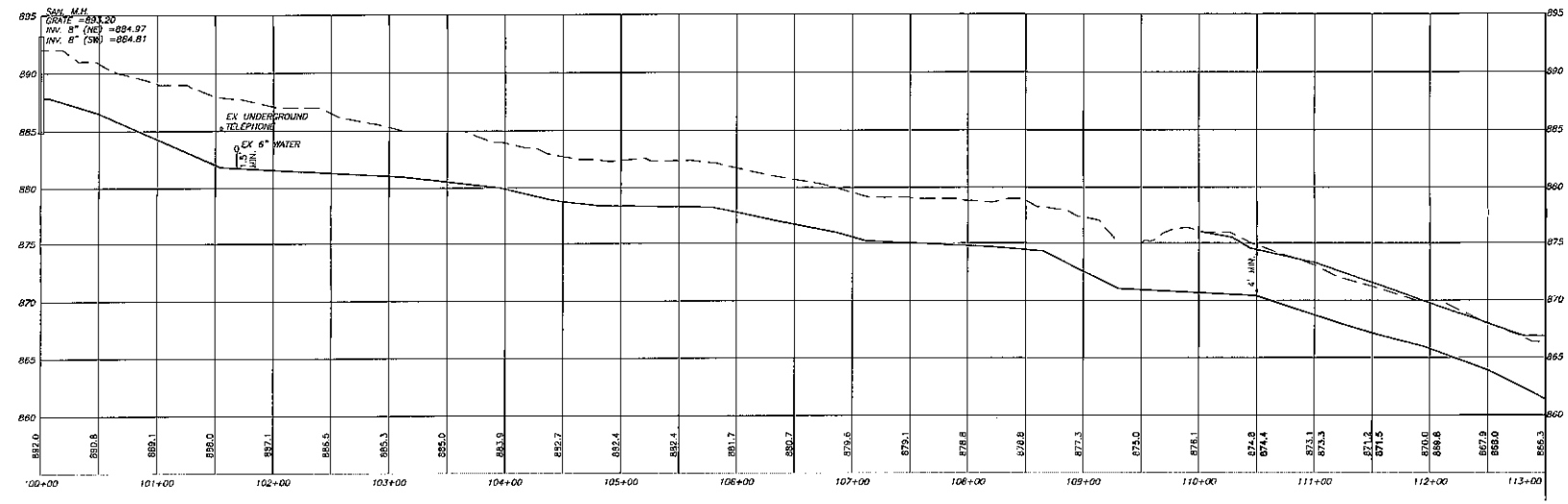


Plan

Scale 1" = 50'

LEGEND

- STM — STORM SEWER LINE
- E — ELECTRICAL LINE
- FM — SANITARY FORCE MAIN LINE
- G — FUEL LINE
- W — WATER LINE
- FIRE HYDRANT
- WATER VALVE
- CURB INLET
- STORM MANHOLE
- STORM CATCH BASIN
- STORM OUTFALL
- STORM PLUG (FUTURE EXTENSION)
- METER VAULT WITH BACKFLOW PREVENTOR



GENERAL NOTES

1. ALL PLASTIC SANITARY SEWER PIPE SHALL BE AIR TESTED IN ACCORDANCE WITH ASTM F-1417.

2. LEAKAGE TESTING, EXFILTRATION OR INFILTRATION SHALL NOT EXCEED 100 GALLONS PER INCH OF PIPE DIAMETER PER MILE PER DAY FOR ANY SECTION OF THE SYSTEM. ISSUE SHALL BE PERFORMED WITH A MINIMUM POSITIVE HEAD OF 2 FEET.

3. ROOF DRAINS, FLOOR DRAINS, AND ALL CLEAN WATER CONNECTIONS SHALL BE PROHIBITED FROM CONNECTING TO THE SANITARY SYSTEMS.

4. A MINIMUM 10 FOOT HORIZONTAL SEPARATION (MEASURED OUT-TO-OUT CLEAR) BETWEEN THE PROPOSED SANITARY SEWER AND EXISTING WATER LINES SHALL BE MAINTAINED.

5. A MINIMUM 18" VERTICAL CLEARANCE (MEASURED OUT-TO-OUT CLEAR) BETWEEN THE PROPOSED SANITARY SEWER AND EXISTING WATER LINES SHALL BE MAINTAINED.

6. ALL WATER LINE SHALL BE PVC PIPE MUST BE DR-18 PIPE FOR UP TO 150 PSI OPERATING PRESSURE. THE PVC PIPE MUST MEET AWWA C-900-07 PVC PRESSURE PIPE MANUFACTURED FROM COMPOUNDS CONFORMING TO PVC CELL CLASSIFICATION OF 12454 AS DEFINED IN ASTM D-1784. BID ITEM TO INCLUDE TRENCHING, BACKFILL, PIPE, FITTINGS, DISINFECTION, BLOCKING, HYDROSTATIC TESTING.

7. SANITARY SEWER SHALL BE SDR 21 PVC, SCHEDULE 40 PVC (200 PSI) OR OTHER APPROVAL MATERIAL. JOINTS SHALL BE IN ACCORDANCE WITH ASTM 3139 AND GASKETS PER ASTM F477. BID ITEM TO INCLUDE TRENCHING, BACKFILL PIPE AND FITTINGS.

Brandstetter Carroll Inc.
LANDSCAPE ARCHITECTS | CIVIL ENGINEERS | SURVEYORS PLANNERS
(513) 651-3234

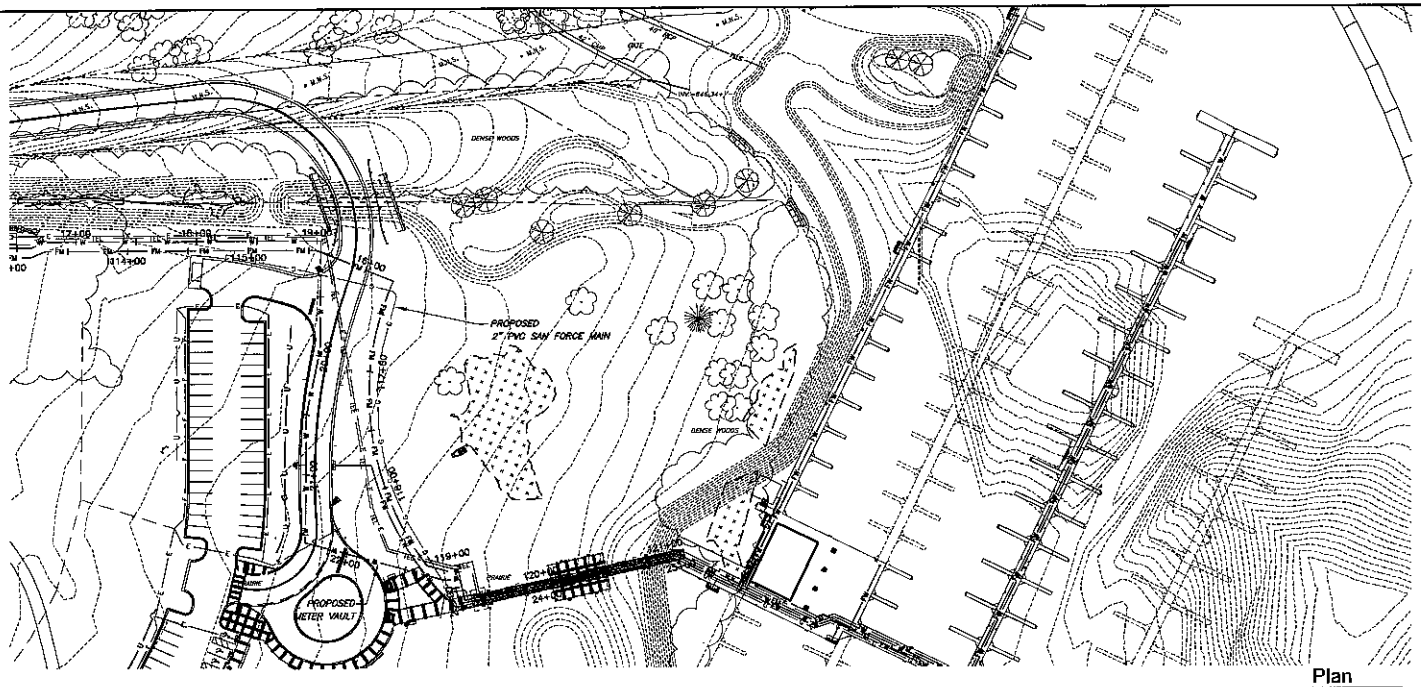
ENGINEERING
Ohio Department of Natural Resources

THE MARINA AT CAESAR CREEK
PHASE 1B - SITE DEVELOPMENT

DESIGNED BY: JTS	PROJECT NUMBER: 0811100SI
DRAWN BY: JTS	SCALE: AS NOTED
CHECKED BY: BBR	DATE: 11/21/2014
APPROVED BY: BLH	REVISED

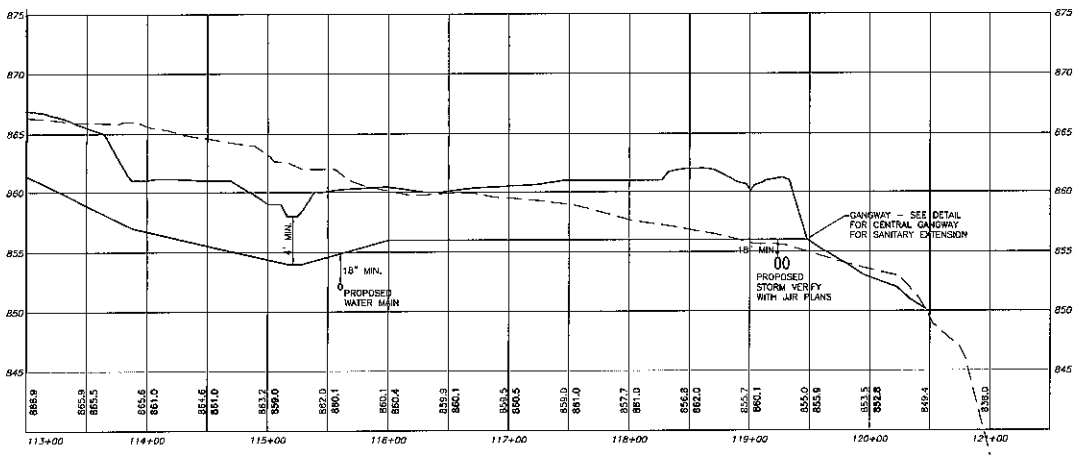
SANITARY FORCE MAIN- North
PLAN AND PROFILE PP-1

C 408



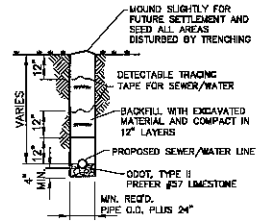
Plan

Scale 1" = 50'



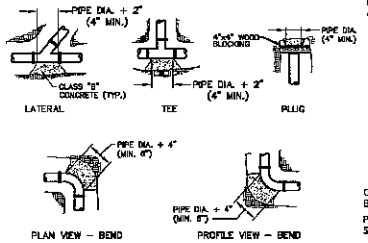
LEGEND

- STORM SEWER LINE
- ELECTRICAL LINE
- SANITARY FORCE MAIN LINE
- FUEL LINE
- WATER LINE
- FIRE HYDRANT
- WATER VALVE
- CURB INLET
- STORM MANHOLE
- STORM CATCH BASIN
- STORM OUTFALL
- STORM PLUG (FUTURE EXTENSION)
- METER VAULT WITH BACKFLOW PREVENTOR



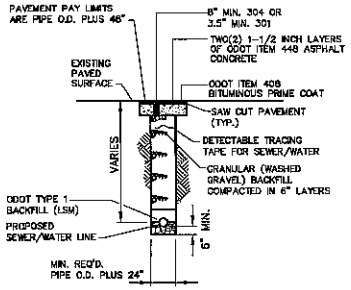
NOTE: SEE SPECIFICATIONS FOR MIX TO BE USED TO SEED ALL AREAS DISTURBED BY CONSTRUCTION.

TRENCH BENEATH OPEN GROUND DETAIL



NOTE: ALL CONCRETE BLOCKING MUST HAVE ITS ENTIRE FACE BEARING AGAINST UNDISTURBED SOIL.

THRUST BLOCK DETAILS



TRENCH BENEATH PAVEMENT DETAIL

Brandstetter Carroll Inc.
LANDSCAPE ARCHITECTS · CIVIL ENGINEERS · SURVEYORS PLANNERS
(513) 591-2234

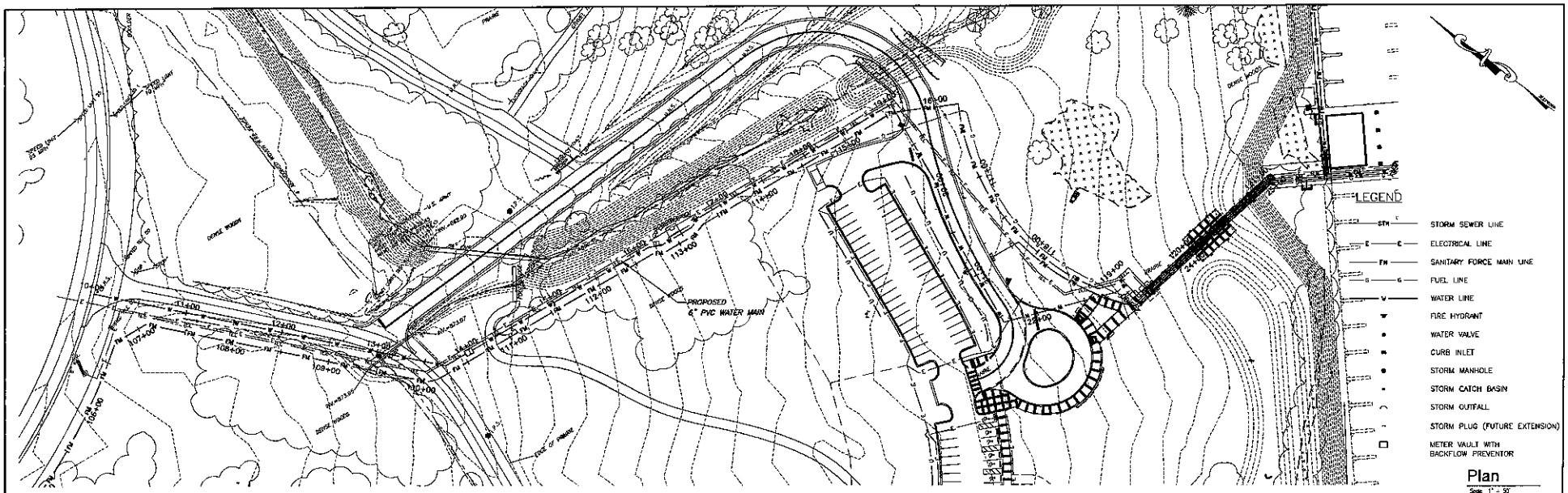
ENGINEERING
Ohio Department of Natural Resources

THE MARINA AT CAESAR CREEK
PHASE 1B - SITE DEVELOPMENT

DESIGNED BY: JJS	PROJECT NUMBER: 0NR130063
DRAWN BY: JRP	SCALE: AS NOTED
CHECKED BY: BBB	DATE: 11/21/2014
APPROVED BY: BEB	REVISED

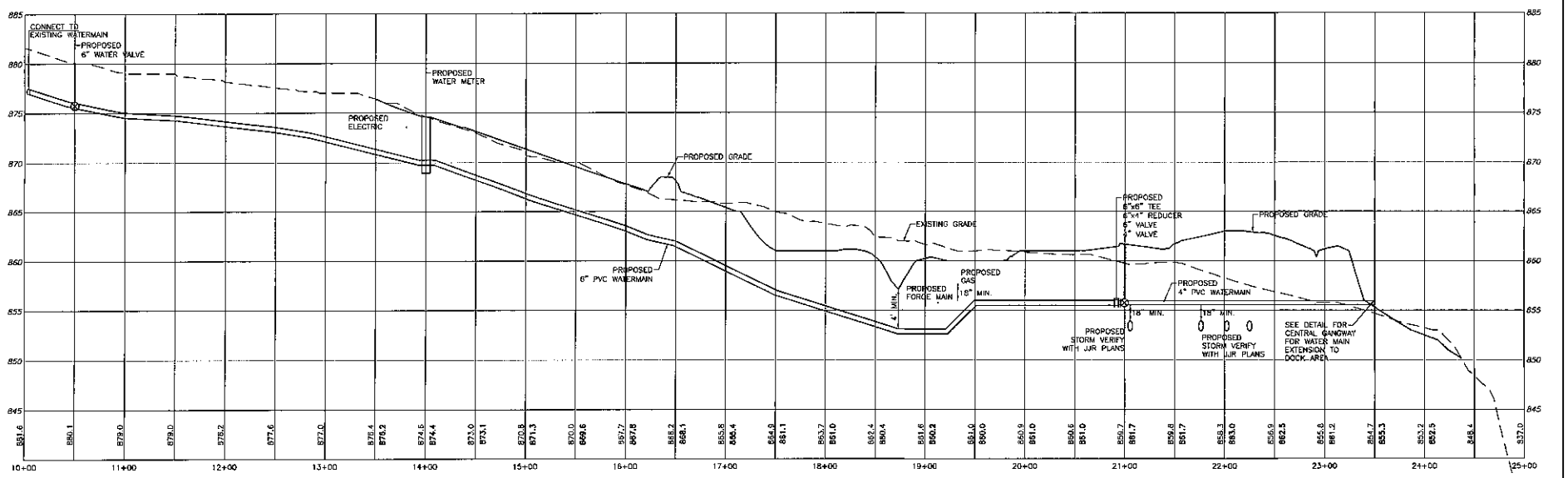
SANITARY FORCE MAIN-South
PLAN AND PROFILE PP-2

C 409



Plan

Scale 1" = 50'



Brandstetter Carroll Inc.
ARCHITECTS ENGINEERS PLANNERS

ENGINEERING
Ohio Department of Natural Resources

THE MARINA AT CAESAR CREEK
PHASE 1B - SITE DEVELOPMENT

DESIGNED BY JTR	PROJECT NUMBER DNR13003
DRAWN BY JTR	SCALE AS NOTED
CHECKED BY BRG	DATE 11/21/2014
APPROVED BY BLB	REVISED

WATER MAIN
PLAN AND PROFILE PP3

C 410

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENGINEERING
2045 MORSE ROAD, BUILDING E-3
COLUMBUS, OHIO 43229-6693
(614) 265-6948

BID DATE: **Thursday, December 18, 2014**

DATE OF ADDENDUM: **Friday, December 12, 2014**

ADDENDUM NUMBER: **2**

TO THE DRAWINGS AND SPECIFICATIONS FOR:

Caesar Creek State Park
The Marina at Caesar Creek
Warren County, Ohio
Project Number DNR - 130053

TO ALL BIDDERS:

THIS ADDENDUM, MODIFYING THE ORIGINAL CONTRACT DRAWINGS AND SPECIFICATIONS, SHALL BE TAKEN INTO ACCOUNT IN PREPARING PROPOSALS, AND IS HEREBY MADE A PART OF THE CONTRACT DOCUMENTS.

NOTICE TO BIDDER

1. Change the date and time that sealed bids will be received to: **Thursday, December 18, 2014 at 2:00 PM EST.**

SPECIFICATIONS

1. **Section 02488 Floating Docks and Gangways**, Item 2.4 Decking on Docks, A. General. Delete and replace the paragraph 3 with the following:

   3. Base Bid decking shall be Ipe.

2. **Section 16600 Marina Slip Utility Pedestals**, Item 1.04 Quality Assurance, A. Qualification, 2. Acceptable Manufacturers. Delete and replace the entire paragraph with the following:

   2. Acceptable Manufacturers:
      a. Will-Burt, Ensign Plus (800) 334-5904
      b. International Dock Products, Inc., S. King Fulton Standard model (800) 909-3625
      c. Lighthouse SS, Eaton Marina Power & Lighting, 800-723-8009
      d. Engineer approved equivalent.

3. **Section 02870 Site Furnishings**, 1.02 Summary, Add the following item immedialty following Item 4 at the end of the section:

   5. Dock Light Pedestal

4. **Section 02870 Site Furnishings**, Part 2 – Materials, Add the following paragraph to the end of the section:

   2.06 DOCK LIGHT PEDESTAL

A. Dock light pedestals shall match the dockside utility centers (DUCs) chosen for the project.

B. Approved manufacturers:

a. "Dockside Lighting, LBB-41," International Dock Products, 3101 S.W. 25th Street, Bay 106 Pembroke Park, Florida 33009; dockproducts.com; 800-909-3625.

b. "Mariner," Eaton Marina Power and Lighting, 149 Warwick Court, Williamsburg, Virginia 23185; 800-723-8009.

c. "Ensign Light," TDI Products, 589 Levy Road, Atlantic Beach, Florida 32233; 904-242-0742.

C. Dock Light Pedestals shall be powder-coated white stainless steel or aluminum

D. Lighting:

a. Light Pedestal shall be equipped with a LED light source oriented to illuminate the deck.

b. Light Pedestal lens shall be clear Lexan.

c. The lumen pattern from the diffuser will not interfere or impede navigation and/or docking in berths.

QUESTIONS AND ANSWERS

Sheet E-103:

1. *MDP-1 is shown as being provided by E.C. On Sheet E-102, detail 2 has a note which states that this panel is provided under separate contract. Is this panel and associated feeders to be included in this bid?*
   a. **Response: Please include this work under the Electrical Contract. There is no "separate contract."**
2. *Sheet E-103 shows panel A as a 3 phase 4 wire 600A panelboard. Note #5 on sheet E-107 states "New Substation / Panel "A". Panel is a single phase 120/240 volt 600A with 160kA TVSS. Disconnect is 480V, 300A, 2 Pole. Which is correct?*
   a. **Response: The "Substation" is not the same as "Panel A." Panel "A" would be installed adjacent to the substation, according to the Eaton Marina Products documentation. Both the substation and the panel are necessary. The Single Line Diagram shall govern the requirements for Panel "A." That is 120/208 3-phase.**

Sheet E-106:

1. *Sheet E-106, Electrical note #10 states that this note #10 is explained on sheet E-105. We cannot find the explanation on sheet E-105. What is the explanation of this note?*
   a. **Response: On Sheet E-106, Coded Note #10 pointing to the DISCONNECT SWITCH next to the transformer is explained as follows: "Provide new 800-AMP Disconnect Switch." See Sheet E-105, Coded Note #10.**
2. *Sheet E-106, electrical note #13 states "controls for parking lot lighting shall be located at panel "C" near transformer. Sheet E-102, plan note #1, shows the location for the lighting contactor to be located in Maintenance 105A. Is note #13 referring to a second lighting control contactor or are the branch circuits for the parking lot lighting to be ran from panel C to the admin building and then back to the parking lot?*
   a. **Response: Sheet E-106, Note #13 shall govern the location of the parking lot lighting controls. Do not run branch circuits from admin building back to the parking lot lights. Controls shall be located at Panel "C."**

Sheet E-107:

1. *Electrical note #10 states to provide connection to light cabinet in this area. Is there a detail for the light cabinet? Which circuit feeds the light cabinet?*
   a. **Response:** Connect light cabinets to new 20A circuit in Panel "A," for instance A-17 or A-18. Shift "Spare" circuits down the panel to reflect any additional circuits. See the Addendum to the specifications
2. *Electrical note #11 states to provide connection to fire cabinet with integral light. Firehouse pedestals are identified as type L6, as per the lighting fixture schedule. Note #11 appears on the boat slip portion of the dock in two locations, but there is no L6's shown at these locations. Are there L6 Firehouse pedestals at the two locations as per note #11?*
   a. **Response: There are L6's at these two locations as depicted on C502 (Fire Staging Areas).**
3. *Electrical note #12 states to provide tele/comm connection to gate in this area. What size and type of conduit is required for this? Is this an empty conduit only or do we need to install and terminate cable for this? If so, what type of cable is required? Is there a detail showing the connection to the gate?*
   a. **Response: The electrical and communications to be coordinated with gate controller per drawing sheet C616.**
4. *There is text (QTY=2) in two locations along the boat slip portion of the dock. What does this text reference?*
   a. **Response: This refers to the two (2) DUC's installed at this location, one on each side of the fire protection staging areas.**

Specifications

1. *There is no specification section for "Raceway and Boxes". Can a specification for "Raceways and Boxes" be provided?*

a. **Response: Underfloor raceways are addressed in Section 16138. All raceways and RMC (Rigid Metal Conduit) for use in wet locations. Box types shall match raceways.**

2. *There is no specification section for "Hangers and Supports". Can a specification for "Hangers and Supports" be provided?*
   a. **Response: Hangers and Supports are addressed in Section 15094.**

END OF ADDENDUM

Hung Thai, P.E., Chief Engineer
Ohio Department of Natural Resources
Division of Engineering

Attachments: None

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENGINEERING
2045 MORSE ROAD, BUILDING E-3
COLUMBUS, OHIO 43229-6693
(614) 265-6948

BID DATE: **Thursday, December 18, 2014**

DATE OF ADDENDUM: **Monday, December 15, 2014**

ADDENDUM NUMBER: **3**

TO THE DRAWINGS AND SPECIFICATIONS FOR:

Caesar Creek State Park
The Marina at Caesar Creek
Warren County, Ohio
Project Number DNR - 130053

TO ALL BIDDERS:

THIS ADDENDUM, MODIFYING THE ORIGINAL CONTRACT DRAWINGS AND SPECIFICATIONS, SHALL BE TAKEN INTO ACCOUNT IN PREPARING PROPOSALS, AND IS HEREBY MADE A PART OF THE CONTRACT DOCUMENTS.

SPECIFICATIONS

1. Delete the **Table of Contents** and replace with the attached **Table of Contents**
2. **Section 02488 Floating Docks and Gangways**, Item 1.10 Design Criteria, B. Environmental conditions, 2. Environmental Loading. Delete and replace the paragraph f. with the following:
   - f. Ice & Snow Loading:
     - i. Snow load per OBC
     - ii. Average Estimated Ice Thickness with Snow: 22.9 inches.
     - iii. Ice Loading shall not include moving ice impact loading.
3. **Section 02488 Floating Docks and Gangways**, Item 1.10 Design Criteria, C. Performance Requirements, 3. Vertical Live Load Design. Delete and replace the paragraph J. with the following:
   - j. During wave action as defined in 1.10 (B)(2)(c), the vertical angular deflection between any two adjoining float modules should not exceed 2 degrees.
4. **Section 02488 Floating Docks and Gangways**, Item 1.10 Design Criteria, C. Performance Requirements, 4. Horizontal Live Load Design. Delete and replace the paragraph d. with the following:
   - d. Displacement
     - i. Maximum allowable horizontal displacement of a mooring line restrained marina dockage system due to the total applied loading conditions for any mooring line constrained dockage shall work in conjunction with the main landside connection gangway system and provide adequate clearance to the

shoreline revetment and attenuator at the full range of water levels.

ii. Maximum allowable horizontal displacement of a mooring line restrained attenuator, without public access, due to the total applied loading conditions for any mooring line constrained attenuator shall work in conjunction with the marina dockage system and provide adequate clearance to the shoreline revetment at the full range of water levels.

iii. Maximum allowable horizontal displacement for the base-bid mooring line restrained attenuator, due to the total applied loading conditions for any mooring line constrained attenuator shall work in conjunction with the main landside marina dockage system and provide adequate clearance to the shoreline revetment and adjacent attenuator at the full range of water levels.

iv. Maximum allowable horizontal displacement for the alternate-bid mooring line restrained attenuator with public access and gangway system, due to the total applied loading conditions for any mooring line constrained attenuator shall work in conjunction with the alternate landside connection gangway system, marina dockage system, adjacent attenuator, and provide adequate clearance to the shoreline revetment at the full range of water levels.

5. **Section 02488 Floating Docks and Gangways**, Item 1.10 Design Criteria, C. Performance Requirements, 4. Horizontal Live Load Design. Delete and replace the paragraph e. with the following:

   e. The structures, floats and anchoring system shall be designed to withstand the forces of non-moving ice without damage. The dockage system will not be removed during the winter months. "Winterization Procedures" for moving ice shall be provided in the winterization manual furnished by the Manufacturer..

6. Add the following attached Spec Sections relating to the Floating Building Plumbing HVAC, Mechanicals, and electrical systems:

DIVISION 22- PLUMBING FOR BUILDINGS

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Section 22 1119 – Domestic Water Piping Specialties	22 1119-1-2
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Section 23 0500 – Common Work Results for HVAC	23 0500-1-4

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Section 23 0523 – General Duty Valves for HVAC Piping 23 0523-1-3
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QUESTIONS AND ANSWERS

Specifications

1. Specification section 16442.2.4.D.1 states to comply with the requirements specified in Division 16 section "fuses." We cannot find this specification section in the bid documents. Can this specification section be issued?

    a. **Response:** Refer to section 26 2813 Fuses for this specification.

2. Specifications for the fueling system require the use of a cylindrical tank, can a rectangular shaped tank section tank be used?

    a. **Response:** Yes.

Sheet E-101

1. Plan note #1 states to connect exhaust fan to local lighting circuit. See detail on sheet E-201.

    a. **Response**: There is no Drawing E-201 included in this bid set. Exhaust fan shall be controlled via local lighting switch as indicated on E-101.

2. Is type MC cable approved for use within the admin building for lighting and power?

    a. **Response:** MC Cable is permit to be to be used within the administration building for fixture and device whips.

Sheet E-102

1. Plan note #1 states to refer to sheet E-201 for details. Please issue sheet E-201. Sheet E-201 is not in the bid package. Will sheet E-201 be issued?

    a. **Response:** There is no Drawing E-201 included in this bid set. The lighting contactor detail is located on Drawing E-101.

2. Panel P1 is shown located in Maintenance 105A. Sheet E-103 has a note above this panel to be located on the exterior of the admin building on the north-east corner. Which is the correct location?

    a. **Response:** Panel P1 shall be located in Maintenance Room #105A as shown on Drawing E- 102.

3. Single line diagram 2/E-102 shows MDP provided under separate contract. Is this correct?

    a. **Response:** There is no separate contract. All panels shown in the drawing set are to be provided by the contractor.

4. Sheet E-102, Detail #2, shows new Panelboard P1 feeder to be (4) #500 in 3-1/2" conduit. Sheet E- 103 (one line) shows this feeder to be (2) sets of (4) #3/0, (1) #3 GND in (2) 2" conduits. Which is correct?

    a. **Response:** The feeder from MDP to Panel P1 shall be either (4) #500 kcmil CU in (1) 3-1/2" conduit or (2) sets of (4) #3/0 CU, (1) #3 GND in (2) 2" conduits. Contractor shall verify lugs in Panel P1 can accommodate parallel conductors if the chosen feeder is (2) sets of (4)
    #3/0 CU, (1) #3 GND in (2) 2" conduits.

END OF ADDENDUM

Hung Thai, P.E., Chief Engineer
Ohio Department of Natural Resources
Division of Engineering

Attachments: Specification Sections as listed above
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DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENGINEERING
2045 MORSE ROAD, BUILDING E-3
COLUMBUS, OHIO 43229-6693
(614) 265-6948

BID DATE: **Monday, December 29, 2014**

DATE OF ADDENDUM: **Thursday, December 18, 2014**

ADDENDUM NUMBER: **4**

TO THE DRAWINGS AND SPECIFICATIONS FOR:

Caesar Creek State Park
The Marina at Caesar Creek
Warren County, Ohio
Project Number DNR - 130053

TO ALL BIDDERS:

THIS ADDENDUM, MODIFYING THE ORIGINAL CONTRACT DRAWINGS AND SPECIFICATIONS, SHALL BE TAKEN INTO ACCOUNT IN PREPARING PROPOSALS, AND IS HEREBY MADE A PART OF THE CONTRACT DOCUMENTS.

NOTICE TO BIDDER

1. Change the date and time that sealed bids will be received to: **Monday, December 29, 2014 at 2:00 PM EST.**

END OF ADDENDUM

Hung Thai, P.E., Chief Engineer
Ohio Department of Natural Resources
Division of Engineering

Attachments: None

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CAESAR CREEK STATE PARK
THE MARINA AT CAESAR CREEK, PHASE 1-REBID
WARREN COUNTY
PROJECT NUMBER DNR-130053

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APPENDIX A Geotechnical Exploration Report for Caesar Creek State Park Marina, 02/28/12

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SECTION 00100
INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL INFORMATION

The construction work called for within this Bidding Package involves work for the State of Ohio, Department of Natural Resources (ODNR) as Owner. Firms submitting bids on this project are cautioned to carefully follow the instructions of this Section to ensure that their bids are responsive to the requirements as presented herein. Questions concerning the construction work called for or questions concerning the bidding requirements may be referred to the Division of Engineering at (614) 265-6948. For a detailed description of the work, please refer to the project drawings and detailed specifications.

PART 2 - PROJECT TIMETABLE

2.1 Recommendation of Award of Contract

The Chief Engineer normally makes a Recommendation of Award of Contract to the Director of ODNR within one week following the opening of the Bids. Bid tabulations will then be forwarded to all Bidders within 3 to 5 days following the approval of the Recommendation of Award of Contract by the Director.

2.2 Execution of the Contract

Normally, the Contract will be signed by the lowest responsive and responsible bidder within 60 days after the opening of the Bids. The Contract is executed when signed by both the lowest responsive and responsible Bidder and the Director of ODNR, and Contract funds are certified in accordance with Section 126.07 of the Revised Code.

2.3 When Work is to Begin

A Notice to Proceed will be issued following the execution of the Contract. Each Bidder's attention is directed to the requirement that all Contractors be prepared to begin work within ten (10) calendar days following the receipt of the Notice to Proceed. The Pre-Construction meeting will also normally be held within this ten day period. (Refer to Part 5 of Section 01000).

2.4 Construction Completion Date

It is understood and agreed that the work embodied in this Contract shall be completed on or before the date specified on the Form of Bid, unless an extension of time is granted in writing by the Chief Engineer of the Department of Natural Resources. Failure to complete the work by the completion date shall subject the Contractor to liquidated damages as described in Part 26 of the General Conditions. This completion date includes an allowance of sixty (60) days for the period between the opening of the Bids and the Notice to Proceed. If requested by the Contractor, an extension of time for completion of the work may be granted for each day beyond the sixty day period if the delay in contract execution is due to the fault of ODNR. However, no extension will be granted by ODNR for delays by the Contractor in submitting the necessary documents required for contract execution.

PART 3 - EXAMINATION OF BID PACKAGE DOCUMENTS

3.1 Completeness of Bid Package

The Contract Documents are intended to be complete for the preparation and submittal of bids. However, the Bidder shall verify to his own satisfaction that all material issued, including addenda, is complete. Should the Bidder discover that a page, sheet, or other item is missing, he shall so notify ODNR, and the missing item(s) will be forwarded to the Bidder. After Bids have been submitted, no claims of ignorance of the requirements of bidding or of construction, due to such missing material, including addenda, will be recognized.

3.2 Bidder's Responsibility to the Project

The submission of a Bid will constitute an incontrovertible representation by the Bidder that he has and will comply with all provisions of the Contract Documents, that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for the performance of the work, and that the Bidder has thoroughly reviewed the Contract Documents and has included all required labor and material in his bid.

NOTE: Since it is not standard practice to detail all controls, wiring, piping and appurtenance, etc. required to render each piece of equipment functional on the drawings, the Bidder is cautioned to ensure that his bid includes all such items necessary to permit the equipment to function as intended in a manner that meets all applicable codes, and provides a complete and operational system.

It is a requirement of the Contract that each prime contractor must perform 25% of the work called for under this contract with the prime contractor's own forces. It is also required that subcontractors utilized under this contract must perform 50% of the work subcontracted to them with their own forces. Prior to final payment for the work, the Contractor will be required to furnish an affidavit substantiating the above.

3.3 Conflicts in the Documents

Should any particular requirement in the drawings and/or specifications for the project appear to a Bidder to be in disagreement with other requirements in the Contract Documents, or if a Bidder is unsure of the intent or meaning of any particular requirement of the Contract Documents, the Bidder shall immediately so notify ODNR. If such notifications are received by ODNR by the date of the pre-bid meeting, ODNR may issue a written clarification or an addendum to all parties recorded by ODNR as having received the bidding documents.

3.4 Use of Documents for Other Purposes

The Ohio Department of Natural Resources, in making copies of the Contract Documents available, does so only for the purpose of obtaining Bids for the work and does not confer a license or grant for any other use.

PART 4 - EXAMINATION OF THE SITE

4.1 Site Visit

The Bidder's attention is directed to the necessity of examining the site of the proposed work. Before submitting a bid, the Bidder is required to inform himself fully of the conditions relating to the cost of construction materials and labor under which the work will be prosecuted and shall make whatever site investigations or site tests he deems necessary. A specific right-of-entry must however be obtained from ODNR prior to any Bidder entering the site.

4.2 Understanding of the Site and Work

The submission of a proposal will be deemed an acknowledgment that the conditions and difficulties that may be encountered in the execution of the work are fully and completely understood, that the drawings, specifications and form of contract are fully understood, and that the methods and means of carrying out the Contract by the Contractor must be such that they will not cause any interruption or interference with the work of any other Contractor, except as may be authorized with the consent and approval of ODNR.

4.3 Availability of Design Reports

Reference is made to Section 01200 for the identification of those reports, investigations and tests of subsurface and latent physical conditions at the site or otherwise, which have been relied upon by ODNR in preparing the Contract Documents. These reports are not guaranteed as to accuracy or completeness, nor are they part of the Contract Documents unless otherwise indicated. Upon request, these documents will be made available to the Bidder.

4.4 Extent and Locations of Subsurface Conditions

The Contract Documents show the existing surface and other underground structures likely to affect the prosecution of the work insofar as they have been determined, but the information shown is not guaranteed as being correct and/or complete. The Bidder is expected to examine the Contract Documents, and the location of the work upon the ground, and consult various utility companies or other sources of information if deemed necessary, in order to judge for himself the potential circumstances affecting the cost of the work or the time required for its completion.

PART 5 - SUBLETTING OF CONTRACT

The Contractor shall perform with his own work force, work amounting to not less than twenty-five percent (25%) of the total cost. It is further a requirement of these Contract Documents that each subcontractor utilized by the Contractor at this project must perform at least fifty percent (50%) of the subcontracted amounts with their own work force. (Refer to Part 3.2 of this Section).

The term "own work force" shall be construed to include only workers employed and paid directly by the Contractor and equipment owned or rented/leased by him, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the prime Contractor. An assignment of contract work is considered synonymous with a subcontract to perform work.

PART 6 - BID GUARANTY/CONTRACT BOND REQUIREMENTS

All bid guarantees must be satisfactory to the Ohio Department of Natural Resources, must be made payable to the State of Ohio, Department of Natural Resources, and must satisfy Section 9.311 of the Ohio Revised Code. The costs for all bid guarantees and contract bonds shall be incorporated into the cost of the various items of work.

The Bid Guaranty requirements for this contract may be met by either one of two ways:

OPTION A. By submitting, with the Form of Bid, a properly executed Bid Guaranty and Contract Bond. If this option is utilized, the Bid Guaranty/Contract Bond form found in the package must be used (located at the front of this bid package) without change of wording and must be for the full amount of the bid plus all additive alternates. If subtractions from the bond amount are made for deductive alternatives, the bond will be insufficient and the bid will be rejected.

The Bid Guaranty and Contract Bond must be signed by an authorized agent of an acceptable surety bonding company and by the Bidder. If the Bidder's surety is a foreign corporation, any requirement for countersignature or payment of a fee or commission that the surety's state of domicile would impose on an Ohio surety doing business in the surety's state of domicile shall be imposed on the Bidder's surety pursuant to Section 3905.41 of the Revised Code. The name and address of both the surety and surety's agent must appear on the Bid Guaranty and Contract Bond. The surety's corporate seals must also be affixed to all copies. The Bid Guaranty and Contract Bond must be supported by credentials showing the power of attorney of the agent, the bonding company Certificate of Compliance, and the financial statement of the bonding company.

OR:

OPTION B. By submitting, with the Form of Bid, a Bid Guaranty in lieu of the Bid Guaranty and Contract Bond referred to above. The Bidder may submit a Bid Guaranty as provided in Division C of Section 153.54 of the Ohio Revised Code in the form of a certified check, cashier's check, or letter of credit pursuant to Chapter 1305 of the Ohio Revised Code.

The amount of the submitted certified check, cashier's check or letter of credit shall be equal to ten percent (10%) of the base bid plus all additive alternates and shall be made payable to the State of Ohio, Department of Natural Resources. If subtraction from the guaranty amount is made for a deductive alternate, the guaranty will be insufficient and the bid will be rejected. If this option is utilized, such bid guaranties shall be held by ODNR until the successful low bidder files the proper contract bonds as required in Part 3 of Section 0400.

The certified check, cashier's check or letter of credit will be returned to the lowest responsive and responsible bidder upon filing of the Bond required in Section 153.54(C) of the Ohio Revised Code. (Refer to Part 3.1 of Section 0400).

If this option of compliance is utilized, the Bidder must furnish with his Bid a statement from a responsible surety to the effect that if the Bidder is selected to enter into a Contract, the surety will provide the necessary contract bond for the full amount of the bid.

PART 7 - INSURANCE REQUIREMENTS

The Bidder shall either submit satisfactory proof of insurance as described in Parts 4, 5, and 6 of Section 00400, or in lieu of proof of insurance shall furnish acceptable certification by an insurance company licensed to do business in Ohio that it will furnish the required kinds and amounts of insurance to the Bidder if he enters into a Contract with ODNR.

PART 8 - WAGE RATE REQUIREMENTS

Wages shall be paid to each employee engaged in the work in the project under this Contract at a rate not less than the prevailing rate of wages for the particular trade or occupation in which he is engaged, as issued by the Bureau of Employment Services of the State of Ohio in accordance with the requirements of Sections 4115.03 through 4115.14 of the Ohio Revised Code (See Section 00200 – Wages and Hours Requirements).

PART 9 - PERMIT AND INSPECTION REQUIREMENTS

The Bidder shall include in his bid the costs to obtain and pay for all required permits and inspections (i.e. electrical, plumbing, Ohio EPA, guarantees, licenses, inspection fees for occupancy, waste disposal fees, etc.), required for the proper execution of the work and not identified within the contract documents as the responsibility of ODNR. These costs shall be included in the various costs of the work.

The Bidder shall also be responsible for determining and paying for the permits, bonds, etc., required by the applicable governmental agencies relating to the use of or work adjacent to or on their roadways. The cost of these items shall be included in the various costs of the work.

PART 10 - TAX EXEMPTION INFORMATION

Material purchased for use and incorporation into the proposed work may be exempt from the State of Ohio sales tax as provided for in Section 5739.02 of the Ohio Revised Code and also from the State of Ohio use tax, Section 5741.01. The amount for "Materials", entered in the Bid Schedule by the Bidder, will be considered to reflect the amount of exemption claimed under this provision. However, purchases by the Contractor of expendable items such as form lumber, tools, oils, greases, fuels, or equipment rentals, are subject to the application of the Ohio sales or use tax. The necessary exemption forms will be furnished by ODNR to the lowest responsive and responsible bidder upon request.

PART 11 - BIDDER'S AFFIDAVITS

Each Bidder, in submitting his bid, states that neither he nor his agents, nor any other party for him, has paid or agreed to pay, directly or indirectly, to any person, firm, corporation or employee of the State any money or valuable consideration for assistance in procuring or attempting to procure the contract herein referred to, and further agrees that no such money or reward will be hereafter paid.

The lowest responsive and responsible Bidder may be a corporation not incorporated under the laws of the State of Ohio. In such case, the lowest responsive and responsible Bidder must submit a certificate from the Secretary of State showing that the successful Bidder is authorized to do business in the State of Ohio. Further, if the lowest responsive and responsible Bidder is a foreign corporation, the Bidder must file a written appointment of a designated agent upon whom process against the corporation may be served in Ohio

pursuant to Section 1703.041(A) of the Ohio Revised Code. If the lowest responsive and responsible Bidder is an individual who is not a resident of Ohio, the Bidder shall be deemed to have designated the Ohio Secretary of State as Bidder's agent for service of process as provided at Sections 4123.751 et seq. of the Ohio Revised Code and as may be provided elsewhere by Ohio law.

PART 12 - AFFIRMATIVE ACTION / EQUAL EMPLOYMENT OPPORTUNITY (EEO)

12.1 EEO Certificate of Compliance Requirement

Before a contract can be entered into, the Bidder must possess a valid EEO certificate of compliance with affirmative action programs obtained from the State of Ohio EEO. Contact information can be found online at:
www.das.ohio.gov/divisions/EqualOpportunity/Certificate ofCompliance.aspx
Please refer to Part 2 of Section 00300 for more information.

12.2 Affirmative Action Compliance

The provisions of Section 153.59 of the Ohio Revised Code, relating to equal employment opportunity, apply to this project. The Bidder must furnish evidence of compliance by one of the two following options:

OPTION A. Prior to the Bid opening, signing the Certification Clause provided on the preprinted bid envelope, adopting the goals and timetables set out in Appendices A and B of the State Equal Employment Opportunity Bid Conditions and fulfilling the requirements contained therein (for further information see Part 3 of Section 0300);

OR

OPTION B. Submitting with the bid an Affirmative Action Plan that has been approved by the State Equal Employment Opportunity Coordinator prior to the opening of the bids. If you are submitting a previously approved Affirmative Action Plan for this project, check the applicable box on the pre-printed envelope. The Affirmative Action Plan must be submitted with the bid, along with the letter of approval by the State EEO Coordinator. (For further information, see Part 4 of Section 00300).

Each Bidder must sign the certification clause provided on the pre-printed bid envelope prior to the opening of the bids.

Note: Compliance with all minority and female EEO requirements is necessary throughout performance on this contract.

PART 13 - BASIS OF BID PRICES

Bid prices shall be based on the Contract Documents, including all Addenda. Bid prices shall cover all costs and expenses to be incurred by the Bidder in performing the work of the contract. The Bidder for the General Trades (Contract I, or as designated in Section 01200) shall incorporate into his bid all costs and expenses in coordinating the work of all contractors on the project.

PART 14 - STANDARDS AND SUBSTITUTIONS

ODNR may identify an item as a “standard” by reference to manufacturer and/or model number. All bids will be evaluated based on the standard. ODNR will not consider a bid in which a substitution for the standard is offered. After the Contract is executed, the Contractor may make a proposal for a substitution of a standard.

PART 15 - ADDENDA

ODNR may issue an Addendum and may provide such by regular mail to all parties recorded by ODNR as having received copies of the Contract Documents. Each Bidder shall bear the responsibility to satisfy himself prior to submitting his bid that the bid is responsive to all Addenda issued. Failure to receive or acknowledge any Addenda shall not release the Bidder from all obligations contained in such Addenda. All Addenda shall become part of the Contract Documents. No other interpretations or clarifications issued prior to the opening of the Bids will have legal effect. Receipt of Addenda shall be noted on the bid schedule.

PART 16 - BIDS FOR ALTERNATES / COMBINED BIDS

Any Bid which does not include the base bid plus each and every alternate may be rejected as being non-responsive. ODNR may select any combination or reject any or all Bids, as best serves the interest of ODNR. The lowest responsive and responsible bidder will be determined by using a total of the base bid or the base bid and selected alternates.

For projects with multiple contracts, ODNR may offer a combined bid option. The bid schedule will clearly state for such projects that each Bidder may submit bids for any number of individual contracts, combined bid(s) for two or more individual contracts, or both

PART 17 – ALLOWANCES

The Contractor shall include in his Bid all allowances stated in the Contract Documents. Items covered by these allowances shall be supplied for such amounts and by such persons as ODNR may direct, but the Contractor will not be required to employ persons against whom he makes a reasonable objection.

Unless otherwise provided in the Contract Documents:

1. These allowances shall cover the cost to the Contractor, less any applicable trade discount, of the materials and equipment required by the allowances delivered at the site, and all applicable taxes;

2. The Contractor’s costs for unloading and handling on the site, labor installation costs, overhead, profit and other expenses contemplated for the original allowances shall be included in the Bid and not in the allowance;

3. Whenever the cost is more than or less than the allowance, the Contract Documents shall be adjusted accordingly by Change Order.

PART 18 - BID SCHEDULE PREPARATION

The Bidder shall submit a complete, balanced, regular, comparable and acceptable Bid. All Bids shall be made only on the Bid Schedule included herein.

The Bid shall be legibly written in ink or typed, with all prices in numerals. For unit price items, Bidders shall fill in the unit price bid for each item, and shall also make an extension based on the estimated quantities. In case of incorrect totaling of amounts, or where the unit bid price and the extension do not agree, the Chief Engineer may exercise his discretion in determining whether the unit bid price or total line price was intended by the Bidder. Any such determination will be final.

If a Bidder submits more than one combined bid for any project, each bid must be completed as if it was submitted alone and shall not refer to other documents for interpretation.

PART 19 – FORM OF BID

The Form of Bid shall be used without change, alteration, or addition. Any change in the wording may cause it to be rejected.

The legal status of the Bidder, whether a corporation, partnership, or sole proprietorship shall be stated on the Form of Bid. All corporate Bidders shall also name the State in which the firm is domiciled.

A partnership Bidder shall, on the firm's letterhead, submit the full names and addresses of all general partners. If necessary, this information may be attached to the Form of Bid on a separate sheet. The signing partner of the partnership shall present evidence that he has lawful authority to sign the Form of Bid, that the signature is binding upon the partnership and that the partnership has legal existence.

When a corporation submits a Bid, the Form of Bid shall be signed in the name of and under the seal of the corporation by a duly authorized officer or agent of the corporation. The signing officer or agent shall also present legal evidence that he has lawful authority to sign the Bid, that the signature is binding upon the corporation and that the corporation has legal existence. If a foreign corporation is the apparent lowest responsive and responsible Bidder, the corporation must present evidence that it is legally authorized to do business in the State of Ohio (See Part 11 of this Section).

The Bidder is required to complete all blanks on the Form of Bid. The names and titles of individuals shall be typed or printed in ink above the signatures.

PART 20 - BID PACKAGE CHECKLIST

Each Bidder must be sure that the following documents, at a minimum, are included in his proposal package:

1. FORM OF BID, signed in ink by the Bidder with all blanks completed and information supplied as required in Part 19.

2. BID GUARANTY/CONTRACT BOND, or other acceptable surety, properly and completely prepared as delineated in Part 6.

3. PROOF OF INSURANCE, as delineated in Part 7.

4. AFFIRMATIVE ACTION COMPLIANCE CERTIFICATION executed on the pre-printed bid envelope as required in Part 12.

5. REQUEST FOR TAXPAYER IDENTIFICATION NUMBER AND CERTIFICATION (IRS FORM W-9).

6. CERTIFICATE OF DRUG FREE WORKPLACE COMPLIANCE.

7. BID SCHEDULE (S), properly and completely prepared as delineated in Part 18.

8. A valid EEO CERTIFICATE OF COMPLIANCE, as described in Part 12 and Section 00300.

9. CERTIFICATE OF WAGES AND HOURS ON PUBLIC WORKS

10. A valid WORKERS COMPENSATION CERTIFICATE issued by Ohio Bureau of Workers' Compensation.

11. COMMITMENT TO PARTICIPATE IN THE EDGE BUSINESS ENTERPRISE PROGRAM form, as described in Section 00500.

12. PROPOSED EDGE BUSINESS ENTERPRISE PARTICIPATION form, as described in Section 00500.

13. DEMONSTRATION OF GOOD FAITH EFFORT documentation, when applicable, as described in Section 00500.

PART 21 - SUBMISSION OF BIDS

Bids must be submitted on or before the bid opening date, prior to the bid opening time, and to the place indicated in the Notice to Bidders. **Bids must be submitted in the sealed pre-printed bid envelope supplied with the bid package, and marked with the name of the project.** Each Bidder shall also place his name, address, the bid opening date and time, and signature/date on the outside of the envelope containing his Bid. It shall be the sole responsibility of the Bidder to ensure the timely submittal of his bid package.

PART 22 - MODIFICATION OR WITHDRAWAL OF BIDS

Prior to the opening of Bids, a Bid may be modified or withdrawn by an appropriate document prepared and signed by the Bidder exactly as the Bid is signed, and delivered to the place where Bids are received.

Following the opening of the Bids, bid withdrawal will be considered only if the Bidder satisfies the requirements of Sections 9.31 or 153.54 (G) of the Ohio Revised Code.

PART 23 - OPENING OF THE BIDS

Bids received prior to the date and time of opening will be kept securely unopened until the specified time, at which time all Bids will be publicly opened and read aloud.

Bids that are received after the time fixed for the opening will not be considered, regardless of the cause.

PART 24 - ACCEPTANCE OR REJECTION OF THE BIDS

ODNR reserves the right to accept or reject any or all bids. As provided in Sections 9.312, 153.09 and 1501.011 of the Ohio Revised Code, in awarding a contract ODNR has the right to consider all elements entering into the question of determining the responsibility and responsiveness of the bidder. Further, any Bid which is incomplete, conditional, obscure, or which contains additions not called for, or irregularities of any kind at the discretion of ODNR may be rejected.

The Bidder is cautioned to also refer to the requirements and/or conditions as presented in Part 2 of Section 00400.

PART 25 - PERIOD BID REMAINS IN EFFECT

Bids for the work covered by this Contract may be held by ODNR for a period of sixty (60) days after receipt of bids and shall continue in full effect and not be subject to withdrawal during that period until a Contract has been executed with the lowest responsive and responsible bidder.

PART 26 – ENCOURAGING DIVERSITY, GROWTH, AND EQUITY (EDGE) PROGRAM

This Contract is subject to the requirements of the State of Ohio Encouraging Diversity, Growth, and Equity (EDGE) Program. Before a contract can be executed, the Bidder must agree to meet the EDGE Participation Goal or provide a Demonstration of Good Faith Effort in attempting to select and utilize EDGE-certified business enterprises. The Bidder should review Section 00500 of this document carefully to understand these requirements and what documentation is to be provided in the bidding package, after bids are opened, and after execution of the Contract.

END OF SECTION

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SECTION 00200
WAGES AND HOURS REQUIREMENTS

PART 1 - WAGE RATE REQUIREMENTS

1.1 Required Wage Rates

The wages to be paid for a legal day's work to laborers, workers or mechanics engaged in work under this Contract shall be not less than the wage rates for those trades or occupations listed on the Ohio Wage and Hour website: www.com.state.oh.us. These wage rates have been predetermined and may be updated periodically by the Director of the Ohio Department of Commerce in accordance with Chapter 4115 of the Revised Code.

The Contractor or subcontractor shall not sublet any work unless specifically authorized to do so by ODNR. The Contractor shall require each subcontractor to pay employees not less than the prevailing rate of wages for the project. The Contractor shall also be responsible that all employees shall be paid not less than the applicable prevailing wage for the project.

The Contractor and each subcontractor shall comply with the provisions, duties and obligations of Chapter 4115 of the Revised Code and are subject to the remedies and penalties of Chapter 4115 of the Revised Code.

After the Award of Contract, if it becomes necessary to employ any person(s) in a trade or occupation not listed herein on the Wage Rate Determination, such person(s) shall be paid not less than such hourly rate as determined by the Ohio Department of Commerce, Bureau of Labor and Worker Safety, and such minimum wage shall be retroactive to the time of the initial employment of such person(s) in such trade or occupation.

1.2 Reporting Requirements

Within ten (10) calendar days following the date of the Notice to Proceed, and prior to the start of any work, the Contractor and each subcontractor shall file with the ODNR Division of Engineering a schedule of the single calendar dates during the life of the contract on which payments of wages to employees are to be made.

The Contractor and each subcontractor shall also submit apprenticeship agreements for all apprentices utilized on the project to ODNR.

The Contractor and each subcontractor are required to file with the ODNR Division of Engineering a certified copy of his payroll for each payroll date. The payroll shall show for each employee paid any wages in connection with this project: his/her name, current street address, social security number, work classification, the hourly rate schedule fixed by the Bureau of Labor and Worker Safety for each classification, the employee's basic hourly rate of pay, the number of hours worked on the project in the applicable pay schedule, number of hours worked each day and the total hours worked for each week during the pay period covered, total wages paid, fringe payments, the amount of any deductions withheld, and an accurate description of all deductions taken from the wages.

The payroll reports shall be filed within two weeks after each pay date and the certification of each payroll shall be executed by the Contractor and/or subcontractor, or duly appointed agent thereof, and shall state that the payroll is correct, complete and that the wage rates

shown are current and the wage rates are not less than those required by Chapter 4115 of the Revised Code.

The Contractor and each subcontractor must file with ODNR a true copy of the complete certified payroll for the pay period. The initial certified payroll report must be received by ODNR within two weeks after the first pay date and monthly thereafter unless otherwise directed by ODNR.

1.3 Posting Requirements

The Contractor shall post in a prominent and accessible place on the site of work a legible statement of the current schedule of wage rates specified in the contract to the various classifications of laborers, workwomen, workmen and mechanics employed. Said statement shall remain posted during the construction period of the contract, per Section 4115.07 of the Revised Code.

1.4 Employee Notification Requirements

On the occasion of the first pay date under this contract, the Contractor and subcontractors shall furnish each employee not covered by a collective bargaining agreement (or understanding between employees and bona fide organizations of labor), with individual written notification of the job classification to which the employee is assigned, the current wage rate schedule determined by the Bureau of Labor and Worker Safety to be applicable to that classification, separated into the base rate or hourly rate of pay, the amount of fringe benefits, and the identity of the ODNR Prevailing Wage Coordinator. The Contractor and subcontractors shall furnish the same notification to each affected employee every time the job classification of the employee is changed, and every time the hourly rate of pay and the fringe benefits are changed.

All such prevailing wage rate notifications to each individual employee must be simultaneously copied to the ODNR Project Representative assigned to the project.

1.5 Availability and Preservation of Records

The Contractor and each subcontractor shall make any records maintained concerning wages and hours paid to employees on the project open to inspection by authorized representatives of ODNR, including the ODNR Prevailing Wage Coordinator, the Bureau of Employment Services, and any other person with right of inspection during normal working hours of business days and as often as may be necessary. Additionally, the street address where the records are kept, the name of the person, street address, and telephone number of the person responsible for keeping and maintaining the payroll records shall be provided to ODNR and other applicable agencies. The Contractor and subcontractor shall notify ODNR of any change and the records shall not be relocated without notification of ODNR.

The Contractor and each subcontractor(s) payroll records shall remain within the State of Ohio for a period of one year following the issuance of the Contract Completion Certificate of the contract under which the records are made. The one year time period is automatically extended upon any request by the State to inspect such records.

1.6 Maintenance of Records

The Contractor and each subcontractor shall keep and maintain for inspection payrolls and basic records relating thereto during the course of the work, and shall preserve accurate payrolls and basic records relating thereto for a period of at least one year thereafter for all laborers and mechanics, including apprentices, trainees, watchwomen, watchmen, and guards, working at the site of the work. Such records shall contain all of the following information for each such employee:

a. Name, Social Security Number and current street address;
b. A chronological listing of all hours worked on all projects by each employee;
c. The total number of hours worked by each employee on the project;
d. Copies of all records required pursuant to Section 4115.03 to 4115.16 of the Revised Code and Administrative Rules 4101:9-4-01 to 4101:9-4-28;
e. The correct job occupation and classification for each employee for each hour worked;
f. The hourly rate of pay for each hour worked, (including rates of contributions for or cost assumed to provide fringe benefits);
g. All disbursements of wages to each employee; and
h. All the deductions from wages paid.

1.7 Wage Affidavits Required

Within ten (10) calendar days following the date of the Notice of Award, the Contractor must submit to ODNR the completed and notarized attached form titled "Certificate of Wages and Hours on Public Works," stating that the Contractor has read and fully understands the wages and hours requirements contained in the bid specifications to this project and the other requirements imposed in Sections 4115.03 to 4115.16 of the Revised Code.

Contractors requiring blank copies of the “Certified Payroll Report” form may visit www.com.ohio.gov/laws/forms.aspx or contact the ODNR Prevailing Wage Coordinator at 2045 Morse Road Bldg E-3, Columbus, Ohio 43229, (614) 265-6948.

Upon completion of the project, the Contractor shall submit to ODNR the Contractor's completed sworn and notarized affidavit stating that he has fully complied with the wage and hour requirements of the Contract Documents, and with Sections 4115.03 to 4115.16 of the Revised Code for this project, and all employees who have performed work on the project have been paid in full the prevailing rate of wage outlined in the schedule of wage rates for this project.

Prior to final payment being made, the Contractor must gather his subcontractor(s) sworn and notarized wage rate affidavits. The Contractor must send his wage rate affidavits and his subcontractor(s) wage rate affidavits to ODNR within ten (10) calendar days following the date of the notification by ODNR.

1.8 Penalty for Violation of Wage Provisions

Violation of the wage rate requirements may result in penalties imposed at Chapter 4115 of the Ohio Revised Code and other sanctions provided by law, including but not limited to suspension, cancellation, or termination of this Contract, forfeiture of contract funds, and civil or criminal prosecution.

END OF SECTION

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SECTION 00300
AFFIRMATIVE ACTION / EQUAL EMPLOYMENT OPPORTUNITY (EEO) REQUIREMENTS

PART 1 - ATTENTION ALL BIDDERS

1.1 Importance of this Section

Certain affirmative action plan / equal employment opportunity (EEO) requirements must be met for your Bid to be considered responsive and responsible. Failure to comply with these requirements may cause the Bid to be rejected as non-responsive.

1.2 Summary of Required Bidder Actions

The lowest responsive and responsible bidder must satisfy BOTH of the following Affirmative Action requirements:

a. Possess a valid certificate of compliance with Affirmative Action Programs issued by the State EEO Coordinator, Ohio Department of Administrative Services (614) 466-8380, dated no earlier than 180 days prior to the date fixed for the opening of bids for this project (see Part 2 of this Section); and

b. Make a commitment to the required State EEO minority work-hour utilization percentages, the women work-hour utilization percentage and the affirmative action steps by signing the EEO certification clause provided on the pre-printed bid envelope (see Part 3 of this Section), or you may submit an affirmative action plan previously approved by the State EEO Coordinator (see Part 4 of this Section).

PART 2 - EEO CERTIFICATE OF COMPLIANCE

2.1 Possession of Certificate Required

In accordance with the requirements of Sections 9.47 and 153.08 of the Ohio Revised Code:

NO CONTRACT SHALL BE ENTERED INTO UNLESS THE BIDDER POSSESSES A VALID CERTIFICATE OF COMPLIANCE WITH AFFIRMATIVE ACTION PROGRAMS ISSUED PURSUANT TO SECTION 9.47 OF THE O.R.C. AND DATED NO EARLIER THAN ONE HUNDRED-EIGHTY (180) DAYS PRIOR TO THE DATE FIXED FOR THE OPENING OF BIDS FOR A PARTICULAR PROJECT.

EEO Certificates of Compliance are valid only for the time period shown on their approval letter. If you have not renewed your firm's application (ADM 3405) with the State of Ohio EEO Coordinator, you must immediately submit a completed Application for Certificate of Compliance with Affirmative Action Programs to the State of Ohio Equal Opportunity Division. Application forms are available online at the following site: www.das.ohio.gov/Divisions/EqualOpportunity/CertificateofCompliance.aspx

If you do not possess a valid certificate, it is necessary that your application be submitted without delay at the above-referenced website.

In order to obtain the certificate:

a. The Application for Certification of Compliance with Affirmative Action Programs must be made to the State EEO coordinator at least ten (10) working days prior to the date that your firm expects to receive the certificate.

b. The application must be fully completed on the standardized form prescribed by the State of Ohio Equal Employment Opportunity Coordinator. The application must include, but is not limited to, the following:

1. The name under which the bidder is presently doing business.

2. All other names under which the bidder has done business as a corporation, partnership, or sole proprietorship within the last five years.

3. The current street address for the business of the bidder.

4. The tax identification number of the bidder.

If your firm should fail to obtain a valid Certificate of Compliance with Affirmative Action Programs from the State of Ohio EEO Coordinator in a timely manner, your firm may not be eligible to receive the Contract award (see Part 7 of Section 00400).

2.2 Failure to Comply with Certificate of Compliance Requirements

A Bidder who fails or refuses to complete or subscribe to the State of Ohio Equal Employment Opportunity Covenant (see APPENDIX A of the Sample Form of Contract following Section 00400), or a Bidder who fails or refuses to send a copy of his valid Certificate of Compliance with Affirmative Action Programs issued pursuant to Section 9.47 of the Ohio Revised Code to ODNR within thirty (30) calendar days of the date of the notice of award, may not be deemed a responsive and responsible bidder and may not be awarded the Contract by ODNR.

Failure of the lowest responsive and responsible bidder to meet this thirty (30) day submittal requirement shall be grounds, at the discretion of ODNR, to void the recommendation of award of Contract (see Part 7 of Section 00400).

PART 3 - AFFIRMATIVE ACTION COMPLIANCE (EEO OPTION A)

3.1 General Requirements

To comply with the Affirmative Action bidding requirements by utilizing EEO Option A (as presented in Part 12 of Section 00100), the Contractor must sign the EEO certification clause on the pre-printed bid envelope, which certifies that your firm will adopt:

a. The Goals and Timetables of Appendix A of the State EEO Bid Conditions; and

b. The Specific Affirmative Action Steps set out in Appendix B of the State EEO Bid Conditions.

3.2 Required Minority Work-Hour Percentages (Appendix A of the State EEO Bid Conditions)

To comply with the State EEO Bid Conditions by utilizing OPTION A, the Contractor must adopt the minority work-hour utilization goals as listed below for Ohio Standard Metropolitan Statistical Areas (SMSA). All percentages listed are in terms of percentages of minority work hours for each trade to be used by the contractor in a designated area.

If the project is located in any of the counties listed below you must use the minority percentages listed for the metropolitan area associated with that county. If the project is located in counties other that those listed below you must use the metropolitan area nearest to the project site.

Metropolitan Area	Included Counties
Akron	Portage, Summit
Cincinnati	Clermont, Hamilton, Warren
Cleveland	Cuyahoga, Geauga, Lake, Medina
Columbus	Delaware, Fairfield,. Franklin, Madison, Pickaway
Dayton	Green, Miami, Montgomery, Preble
Toledo	Lucas, Wood
Youngstown	Mahoning, Trumbull

In addition to the percentages given below, it is further required that the contractors statewide workforce be comprised of a minimum of 6.9% work-hour utilization for women.

AKRON

TRADE	
Asbestos Workers	10.0%
Boilermakers	10.0%
Bricklayers	10.0%
Electricians	10.0%
Elevator Constructors	10.0%
Glaziers	10.0%
Ironworkers	10.0%
Lathers	10.0%
Operating Engineers	10.0%
Painters	10.0%
Plasters	10.0%
Plumbers	10.0%
Roofers	10.0%
Sheet Metal Workers	10.0%
Other Trades	10.0%

CINCINNATI

TRADE	
Asbestos Workers	9.0%
Boilermakers	9.0%
Carpenters	10.0%
Elevator Constructors	11.0%
Floor Layers	10.0%
Glaziers	10.0%
Lathers	10.0%
Marble, Tile & Terrazzo Workers & Helpers	8.0%
Millwrights	10.0%
Operating Engineers	11.0%
Painters	11.0%
Pipefitters	11.0%
Plasterers	10.0%
Plumbers	11.0%
Sheet Metal Workers	11.0%
Other Trades	11.0%

COLUMBUS

TRADE	
Asbestos Workers	10.0%
Boilermakers	10.0%
Bricklayers	10.0%
Carpenters	10.0%
Cement Masons	10.0%
Electricians	10.0%
Elevator Constructors	10.0%
Glaziers	10.0%
Ironworkers	10.0%
Lathers	10.0%
Operating Engineers	10.0%
Painters	10.0%
Plasterers	10.0%
Plumbers & Pipefitters	10.0%
Roofers	10.0%
Sheet Metal Workers	10.0%
Other Trades	10.0%

CLEVELAND

TRADE	
Asbestos Workers	17.0%
Boilermakers	10.0%
Carpenters	16.0%
Electricians	20.0%
Elevator Constructions	16.0%
Glazier	17.0%
Ironworkers	13.0%
Operating Engineers	17.0%
Painters	17.0%
Pipefitters	17.0%
Plasterers	20.0%
Plumbers	17.0%
Roofers	17.0%
Other Trades	17.0%

DAYTON

TRADE	
Asbestos Workers	11.0%
Boilermakers	11.0%
Carpenters	11.0%
Electricians	11.0%
Elevator Constructors	11.0%
Ironworkers	11.0%
Lathers	11.0%
Millwrights	11.0%
Operating Engineers	11.0%
Painters	11.0%
Plumbers	11.0%
Sheet Metal Workers	11.0%
Other Trades	11.0%

TOLEDO

TRADE	
Asbestos Workers	9.0%
Boilermakers	9.0%
Carpenters	9.0%
Electricians	9.0%
Elevator Constructors	9.0%
Glaziers	9.0%
Ironworkers	9.0%
Lathers	9.0%
Operating Engineers	9.0%
Painters	9.0%
Plumbers	9.0%
Sheet Metal Workers	9.0%
Other Trades	9.0%

YOUNGSTOWN-WARREN

TRADE		TRADE	
Asbestos Workers	9.0%	Operating Engineers	9.0%
Bricklayers	9.0%	Painters & Decorators	9.0%
Carpenters	9.0%	Plumbers, Pipefitters, & Steamfitters	9.0%
Electrical Workers	9.0%	Sheet Metal Workers	9.0%
Elevator Constructors	9.0%	Teamsters & Chauffeurs	9.0%
Floor Mechanics	9.0%	Tile, Marble, & Terrazzo Workers	9.0%
Glaziers	9.0%	Other Trades	9.0%
Ironworkers	9.0%		
Lathers	9.0%		

3.3 Required Female Work-Hour Percentages

The work-hour utilization for women workers in each trade for all geographical areas shall be a goal of 6.9% of the Contractor's/subcontractor's total work hours.

The Contractor's and subcontractor's good faith effort to comply with this 6.9% work-hour utilization goal shall be reviewed and determined according to Chapter 123.2-1 through Chapter 123:2-9 of the Ohio Administrative Code.

3.4 Required Affirmative Action Steps (Appendix B of the State EEO Bid Conditions)

To comply with the State EEO bid conditions by utilizing Option A, the Contractor, by signing the EEO Certification Clause on the pre-bid envelope, also agrees to adopt the following specific Affirmative Action Steps:

a. Maintain Active Minority Labor Files

The Contractor shall maintain a file of the names and addresses of minority and women construction resource organizations for trades utilized by the Contractor.

Also, the Contractor shall maintain a file of the names and addresses of each minority and female referred to the Contractor by any individual or minority and women resource organization, what action was taken with respect to each such referred individual, and if the individual was not employed by the Contractor the reasons therefore. If such individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union, or if referred, but not employed by the Contractor, the file should document this and the reasons therefore.

To demonstrate compliance, the Contractor should maintain a file of the names, addresses, telephone numbers, and contact person of each minority and women construction resource organization of trades utilized by the Contractor showing the date of contact, and follow-up contacts when the Contractor was hiring.

The Contractor should also maintain a file of the names, addresses, telephone numbers, and craft of each minority and female applicant showing (a) the date of

contact and whether the person was hired; if not, the reason, (b) if the person was sent to a union for referral, and the results (c) follow-up contacts when the Contractor was hiring.

b. Documentation of Lack of Union Cooperation

The Contractor should promptly notify the State Contracting Agency when the Union with which the Contractor has collective bargaining agreements does not refer to the Contractor a minority or female worker referred to the union by the Contractor, or when the Contractor has information that the union referral process has impeded efforts to meet its goals.

To demonstrate compliance, the Contractor should have documentation that indicates the union is impeding the Contractor's effort to comply.

c. Internal Dissemination of EEO Policies

The Contractor should disseminate its Equal Employment Opportunity (EEO) policy within its organization by including it in any company newsletters and annual reports; by advertising at reasonable intervals in union publications; by posting of the policy; by specific review of the policy with minority and female employees; and, by conducting staff meetings to explain and discuss the policy.

To demonstrate compliance, the Contractor should have a written EEO policy which includes the name and how to contact the Contractor’s EEO Officer and: (a) include the policy in any company policy manuals; (b) post a copy of the policy on all company bulletin boards, both in the office and on all job sites; (c) maintain records, such as reports or diaries, etc., that each minority and female employee is aware of the policy and that it has been discussed with them; (d) ensure that the policy has been discussed regularly at staff meetings; and (e) maintain three (3) copies of newsletters and annual reports which include the policy.

d. Monitor Internal EEO Compliance

The Contractor should continually monitor all personnel activities to ensure that its EEO policy is being carried out, including the evaluation of minority and female employees for promotional opportunities on a quarterly basis and the encouragement of such employees to seek those opportunities.

To demonstrate compliance, the Contractor should have records that the company EEO Officer reviews all: (a) monthly workforce reports; (b) hiring and terminations; (c) training provided on-the-job; and (d) minority and female employees quarterly for promotion and encourages them to prepare for and seek promotion. The maintenance of these records should be included in the EEO Officer’s job description, reports, memos, personnel files, etc., documenting the activities for possible discriminatory patterns.

e. External Dissemination of EEO Rules

The Contractor should disseminate its EEO policy externally by informing and discussing it with all recruiting sources; by advertising it in news media, specifically

including minority and female news media; and by notifying and discussing it with all subcontractors.

To demonstrate compliance, the Contractor should have copies of: (a) letters sent, at least every six months or at the start of each new major contract, to all recruiting sources (including labor unions) requiring compliance with the policy; (b) advertising which has the EEO "tagline" on the bottom; and (c) purchase order forms and subcontract agreements will include or make reference to the State EEO Covenant.

f. Initiate Minority Recruitment Efforts

The Contractor should make specific and reasonably recurrent oral and written recruitment efforts directed at minority and women construction crafts resource organizations, and construction crafts training organizations within the contractor's recruitment area.

To demonstrate compliance, the Contractor should have a record either in a follow-up file for each organization or on the reverse of the notification letters sent under item a., above, of the dates, individuals contacted, and the results of the contact from telephone calls or personal meetings with the individuals or construction resource groups notified under item a.

g. Develop Minority On-the-Job Training

The Contractor, where reasonable, should develop on-the-job training opportunities and participate and assist in all Department of Labor funded and/or approved training programs (including Apprenticeship Programs) relevant to the Contractor's employee needs consistent with its obligations in the Contract Documents.

To demonstrate compliance, the Contractor should have records of contributions made in cash, equipment supplied and/or Contractor personnel provided as instructors for Bureau of Apprenticeship and Training approved or Department of Labor funded training programs and records of the hiring and training of minorities and females referred to company by such programs.

h. Solicit Bids from Minority and Women Subcontractors

The Contractor should solicit bids for subcontractors (and joint ventures) from available minority and female subcontractors engaged in the trades covered by the Contract Documents, including circulation of minority and female contractors associations.

To demonstrate compliance, the Contractor should maintain copies of letters or other direct solicitation of bids for subcontractors/joint ventures from minority/female contractors with a record of the specific responses and any follow-up the contractor has done to obtain a price quotation or to assist a minority/female contractor in preparing or reducing a price quotation; have a list of all minority/female subcontracts awarded or joint ventures participated in with the project name, project number, dollar amounts, minority/female company name, FTID number, scope of work, start date, completion date, etc.

PART 4 - AFFIRMATIVE ACTION COMPLIANCE (EEO OPTION B)

4.1 Contacting the State EEO Coordinator's Office

To comply with the State EEO Bid Conditions by utilizing EEO Option B (as presented in Part 12 of Section 00100), the Contractor must submit an acceptable Affirmative Action program to the State EEO Coordinator prior to the opening of the Bids, and the Contractor must include with his Bid a copy of the letter that has been previously approved by the State EEO Coordinator (614) 466-8380. The Contractor must also sign and check the applicable box on the pre-printed bid envelope.

IMPORTANT: If Option B is utilized, you must also include with your bid, a copy of the signed letter from the State EEO Coordinator approving your Affirmative Action plan.

The information in Part 4.2 and Part 4.3 of this Section is presented to state the purpose and basic contents required in an acceptable Affirmative Action program. Further information should be obtained from the State of Ohio Equal Opportunity Division at (614) 466-8380.

4.2 Purpose of Affirmative Action Programs (Section 3.04 Implementing Rules and Regulations)

An Affirmative Action program is a set of specific and result-oriented procedures to which a Contractor shall apply every good faith effort. The objective of those procedures and efforts is to assure equal employment opportunity. An acceptable Affirmative Action program will include an analysis of all trades employed by the Contractor within the last year, with an explanation of whether females and/or minorities are currently being underutilized in any one or more trades. A necessary prerequisite to the development of a satisfactory Affirmative Action program is the identification and analysis of problem areas inherent in minority employment and an evaluation of opportunities for utilization of minority group personnel.

4.3 Basic Contents of an Acceptable Affirmative Action Program, Part-I

1. Development or reaffirmation of the Contractor's Equal Employment Opportunity policy in all personnel actions.

2. Formal internal and external dissemination of the Contractor's policy.

3. Establishment of responsibilities for implementation of the Contractor's Affirmative Action program.

4. Identification of problem areas (deficiencies) by organizational units and job classification.

5. Establishment of goals and objectives by organizational units and job classification, including timetables for completion.

6. Development and execution of action-oriented programs designated to eliminate problems and further designed to attain established goals and objectives.

7. Design and implementation of internal audit and reporting systems to measure effectiveness of the total program.

8. Compliance of personnel policies and practices with the sex discrimination guidelines (41 CFR PART 60-20).

9. Active support of local and national community action programs and community service programs, designed to improve the employment opportunity of minorities.

10. Consideration of ethnic minorities and women not currently in the work force having requisite skills who can be recruited through affirmative action measures.

11. Summary data on applicant flow, hires, terminations and promotions, and training for the last 12 months or the last 100 applicants, hires, etc., whichever is less.

Analysis of Individual Trades, Part-II

12. The minority population of the labor area surrounding the Contractor's or subcontractor's job sites.

13. The size of the minority unemployment rate in the labor area surrounding the Contractor or subcontractor's job sites.

14. The percentage of the minority work force in the immediate labor area.

15. The general availability of minorities in the immediate labor area.

16. The availability of minorities in an area from which the contractor or subcontractor can reasonably recruit.

17. The availability of promotable minorities within the Contractor's or subcontractor's workforce.

18. The anticipated expansion, reduction and turnover of the Contractor's or subcontractor's workforce.

19. The existence of qualified training institutions.

20. The degree of training the Contractor or subcontractor is reasonably able to provide to make all job classes available to minorities.

4.4 Maintaining an Acceptable Affirmative Action Program

Goals, timetables and Affirmative Action commitments must be designed to correct any identifiable deficiencies. Where deficiencies exist and where numbers or percentages are relevant in developing corrective actions, the Contractor shall establish and set forth specific goals and timetables. Such goals and timetables, with supporting data and the analysis thereof, shall be a part of the Contractor's written Affirmative Action program.

Where the Contractor has not established a goal, the Contractor's written Affirmative Action program must specifically analyze each of the twenty factors listed in Part 4.3 of this Section

and further must detail the Contractor's reason for a lack of a goal. The goals and timetables should be attainable in terms of the Contractor's analysis of deficiencies and his entire Affirmative Action program. Thus, in establishing his goals and timetables, the Contractor should consider the results which could be reasonably expected from his good faith efforts to make his overall Affirmative Action program work. If the Contractor does not meet the Contractor's goals and timetables, the Contractor's "good faith efforts" shall be judged by whether the Contractor is following his program and attempting to make it work toward the attainment of his goals.

Support data for the above analysis and program shall be compiled and maintained as part of the Contractor's Affirmative Action program. This data should include applicant flow data and applicant rejection ratios indicating minority status.

4.5 Determining the Status of a Contractor's Compliance

The status of a Contractor's compliance with the Affirmative Action program requirements shall not be judged alone by whether or not the Contractor reaches the Contractor's goals and meets the Contractor's timetables. Rather, each Contractor's compliance posture shall be reviewed and determined by reviewing the contents of his program, the extent of the Contractor's adherence to the Contractor's program, and the Contractor's good faith efforts to make his program work toward the realization of the program's goals within the timetables set for completion.

PART 5 – DISCRIMINATION AND INTIMIDATION

The prohibitions against discrimination and intimidation on account of race, color, religion, sex, sexual orientation, national origin, disability, age, ancestry or military status, and the provisions as to forfeitures to be applied in the event of violation of Contract terms regarding same, as contained in Sections 153.59, 153.60, 153.591 and 4112.02 of the Revised Code, and Executive Order 11246 shall apply to all Contracts entered into in connection with the work.

PART 6 – EMPLOYMENT UTILIZATION REPORTS

6.1 General Requirements

The Contractor and the Contractor's subcontractor(s), during the course of construction, shall complete, on a monthly basis, Statewide and State Project Employment Utilization Reports (Input Form 29). Statewide reports must be submitted to the State of Ohio EEO Coordinator. Instructions for completing the Input 29 forms and blank forms are available online at the site below.

6.2 Reporting Requirements

To provide factual information as to the make-up of the Contractor's total work force in the State of Ohio, the Contractor and all of the Contractor's subcontractor(s) shall furnish for their statewide workforce the completed Input Form 29: For Contractors' Employment Utilization Reporting of Work Hour Data by Race and Sex, to the State of Ohio Equal Opportunity Division.

a. All prime contractors and subcontractors are required to submit a monthly work hour report to include the contractor's total workforce (private and public work hours) within the State of Ohio. The Input Form 29 must be electronically submitted by the tenth of each month at the following site:
www.das.ohio.gov/Divisions/Equal Opportunity/InputForm29.aspx

All Prime Contractors and Subcontractors, effective September 1, 2007, performing on state or state assisted construction contracts must submit an Input Form 29 regardless of the number of employees employed by the company or state contract amount

The prime Contractor's Input Form 29 reporting period extends from the calendar month with the Notice to Proceed of the Contract through the calendar month when ODNR issues the Certificate of Completion that the work has been accepted under the conditions for the Contract.

A subcontractor(s) Input Form 29 reporting period begins the calendar month that subcontractor(s) start work on this project and continues as long as the subcontractor(s) conduct work under this Contract.

b. The Prime Contractor is responsible for informing its' subcontractor(s) (regardless of tier) as to their respective Affirmative Action program obligations under the Contract Documents. All Contractor(s)/subcontractor(s) must refrain from entering into any subcontract subject to the Department of Public Works Regulations on EEO, with a contractor or materialman who has been debarred, pursuant to the DPW Regulations on EEO, from all State or State-assisted construction contracts. Contractor(s)/subcontractor(s) shall carry out such sanctions and penalties for violation of the Contract Documents, including suspension, termination and cancellation of existing subcontracts and purchase agreements as may be imposed or ordered by the State of Ohio Equal Employment Opportunity Coordinator pursuant to the DPW Regulation on EEO. Any Contractor/subcontractor who fails to carry out such sanctions and penalties shall be deemed in non-compliance with the Contract Documents and DPW Regulation on EEO.

c. The Contractor/ subcontractor(s) failure to submit a monthly Input Form 29 Statewide Employment Utilization Work Hour report to the State of Ohio Equal Opportunity Division, or the Contractor/subcontractor's failure to submit a monthly Input Form 29 Statewide Employment Utilization Work Hour may be a basis for invoking any of the sanctions set forth in Rule 123:2-7-01 of the Ohio Administrative Code.

6.3 Discrimination Policy

By submitting a bid, the Contractor agrees that in the hiring of employees for the performance of work under this Contract or any subcontract, no Contractor, subcontractor, or any person acting on his behalf, shall, by reason of race, color, religion, sex, sexual orientation, national origin, disability, age, ancestry or military status, discriminate against any citizen of the State in the employment of labor or workers who are qualified and available to perform the work to which the employment relates.

In the event of the Contractor or subcontractor's noncompliance with the nondiscrimination clauses, the Contract may be terminated or suspended in whole or in part, and the

Contractor and the subcontractor may be declared not responsive or responsible for future State or State-Assisted contracts or such other sanctions as provided in Section 153.60 of the Revised Code.

6.4 Discrimination by Hiring Hall

Per Section 158.591 of the Revised Code, any provision of a hiring hall contract or agreement which obligates a Contractor to hire, if available, only such employees as are referred to the Contractor by a labor organization shall be void as against public policy and unenforceable with respect to the employment under such public improvements Contract, unless, at the date of execution of such hiring hall contract or agreement, or within thirty (30) days thereafter, such labor organization has in effect procedures for referring qualified employees for hire without regard to race, color, religion, sex, sexual orientation, national origin, disability, age, or military status, unless such labor organization includes in its apprentice and journeyman membership, or otherwise has available for job referral without discrimination, qualified employees in accordance with Section 153.91 of the Revised Code.

6.5 Penalty for Breach of these Provisions

Breach of these provisions subjects the Contractor to penalties and sanctions imposed by law, including but not limited to the termination of this Contract.

PART 7 – AFFIRMATION ACTION PROGRAM COMPLIANCE REVIEWS

7.1 Pre-Award Compliance Reviews

The successful Contractor and the Contractor's subcontractor(s) may be subject to pre-award compliance reviews.

The State Equal Opportunity Division or the ODNR Contract Compliance Section will notify the successful Contractor and the Contractor's subcontractor(s) of the information required for the off-site reviews. The information requested by the State Equal Opportunity Division and ODNR for the off-site reviews must be submitted by the successful Contractor and the Contractor's subcontractor(s) not later than ten (10) business days after the date of receipt of the request. The information must be sent to the address as directed by the State of Ohio Equal Employment Opportunity Coordinator or as directed by ODNR.

7.2 Incorporation of Commitment to Contract Documents

The Contractor agrees with the State to incorporate into this Contract the Affirmative Action program commitments that the Contractor has agreed to in writing with the State of Ohio Equal Employment Opportunity Coordinator, ODNR, and the Office of Federal Contract Compliance. Where the Contractor has been found to have violated an Affirmative Action program commitment which the Contractor has agreed to in writing, thereafter any contract shall be terminated by the State, and further the Contractor agrees to hold the State harmless whenever a contract shall be terminated.

END OF SECTION

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SECTION 00400
EXECUTION OF THE CONTRACT

PART 1 - TABULATION OF THE BIDS

1.1 Correction of Mathematical Errors

Where there is a conflict between the unit bid price and the extension thereof made by the Bidder, the Chief Engineer is authorized to use his discretion in determining whether the unit prices or the extended amounts were intended and to make the corrections in the Bids as necessary and to use such corrections in comparing Bids. Any such determination of the Chief Engineer is final.

1.2 Preparation and Distribution of Bid Tabulation

All bids received in conformity with these Contract Documents will, as soon as practicable, be tabulated and the tabulations shall become a public record. Printed copies of the tabulations will be mailed to all bidders.

PART 2 - RECOMMENDATION OF AWARD OF CONTRACT

2.1 ODNR's Right to Reject Bids

ODNR reserves the right to accept or reject any and all bids, and may reject any or all bids or may select any combination of bids and alternate bid items as best serves its interests. As provided in Sections 9.312, 153.09, and 1501.011 of the Ohio Revised Code, in awarding a contract ODNR has the right to consider all elements entering into the question of determining the responsibility and responsiveness of the Bidder. Bids that are obscure or contain irregularities of any kind may be rejected at the discretion of ODNR.

2.2 ODNR's Right to Waive Informalities

ODNR also reserves the right to waive any and all curable informalities or irregularities, or to clarify Contract terms with the lowest responsive and responsible Bidder, if such a waiver is in the best interest of the State.

2.3 Factors Influencing Award

If a Contract is awarded, it will be awarded to the lowest responsive and responsible Bidder whose evaluation by ODNR indicates that the award will be in the best interest of the State.

In the determination of the lowest responsive and responsible Bidder, ODNR reserves the right to take into account and give reasonable weight to:

a. The experience of the Bidder;

b. The financial condition of the Bidder;

c. The conduct and performance of the Bidder on previous contracts, which shall

include, without limitation, compliance with Equal Employment Opportunity, Affirmative Action requirements, EDGE and prevailing wage laws;

d. The Bidder's facilities;

e. The Bidder's management skills;

f. The Bidder's ability to execute the Contract properly;

g. The probability of the Contract being carried to successful completion, within the time specified, by the methods and with the equipment the Bidder proposes to use;

h. The Bidder's responsiveness to all requirements of the Contract Documents; and

i. Default under previous contracts.

2.4 Contractor's Qualification Statements by the Low Bidder

The Bidder to whom award of a Contract is under consideration may be required to submit to ODNR any information that ODNR deems necessary regarding the Bidder's ability to successfully prosecute the work. The lowest responsible bidder may be required to submit evidence that the work will be performed by personnel properly licensed and bonded by the State of Ohio.

2.5 Unresolved Findings for Recovery

In accordance with Section 9.24 of the Revised Code, ODNR is prohibited from awarding a contract for goods, services, or construction, paid for in whole or in part with state funds, to a person against whom a finding for recovery has been issued by the auditor of state, if the finding for recovery is unresolved. Prior to completion of the Bid Tabulation and recommendation of award of Contract, ODNR shall verify contractor's compliance with the requirements of Section 9.24.

2.6 Recommendation of Award

Upon consideration of the above factors, the Chief Engineer will forward to the Director the Bid Tabulation with a recommendation of award of Contract. Upon the receipt of the approval of the Director, the approved Bid Tabulation will be mailed to all Bidders by regular mail, identifying the lowest responsive and responsible Bidder.

2.7 Protest of Notification of Award

A Bidder who is notified that his Bid is not responsive and responsible may object to this determination by filing a written protest that must be received by ODNR within five (5) calendar days of the date of notification. Upon receipt of a timely protest, ODNR shall set the date, time, and location to meet with the protesting Bidder and hear his objections. Chapter 119 of the Revised Code shall not be applicable to such a meeting, pursuant to Section 9.312 of the Revised Code.

If all protests are rejected, the award of the Contract shall be affirmed by the Director or all Bids shall be rejected.

PART 3 - CONTRACT BOND REQUIREMENTS

3.1 Value of Bonds

If the lowest responsive and responsible bidder has submitted a Bid Guaranty in lieu of the Bid Guaranty and Contract Bond (as described in Part 6 of Section 00100), the lowest responsive and responsible Bidder shall be required to furnish a Contract Bond, utilizing the form provided by ODNR, for a sum not less than one hundred (100) percent of the total price of the Contract, inclusive of all additional alternates and without deduction for deductive alternates. In this case, immediately following the recommendation of award of the Contract, the lowest responsive and responsible bidder will be notified in writing of the requirement to submit the required bonding documents within ten (10) days following the date of the Notice of Award. Each bond shall be an obligation of an approved surety company, authorized to do business in the State of Ohio and shall be written to include all alternatives chosen.

3.2 Certification Required by Surety Companies

Agents of bonding companies that write bonds for this Contract shall furnish power of attorney, bearing the seal of the company, evidencing such agent's authority to execute the particular type or types of bonds to be furnished. A copy of this proof shall be attached to each signed copy of the Contract. All bonds signed by an agent shall be accompanied by a certified copy of the authority to act (Power of Attorney).

3.3 Period to be Covered By Bond

The Bond shall remain in effect for at least one year beyond the date of signing of the Completion Certificate by the Director.

PART 4 - LIABILITY INSURANCE REQUIREMENTS

4.1 Minimum Amounts of Insurance

At all times during the performance of this Contract, each Contractor shall maintain insurance to protect the Contractor and ODNR from claims for personal injury, direct or derivative, including death or claims for property damage resulting from operations under this contract, by the Contractor or the Contractor's subcontractors, or anyone directly or indirectly employed by them. Said policies shall be in the following minimum amounts.

Bodily Injury	$1,000,000/$1,000,000 Limit Minimum
Property Damage	$1,000,000 Limit Minimum

4.2 Type of Coverage Required

At a minimum, the liability insurance shall cover the following types of claims:

a. Claims under workers' or workmen's compensation, disability benefits and other

similar employee benefit acts;

b. Claims for damages because of bodily injury, occupational sickness or disease, or death of employees;

c. Claims for damages because of bodily injury, sickness or disease, or death of any person other than employees;

d. Claims for damages, insured by personal injury liability coverage, which are sustained (1) by any person as a result of an act directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person for any other reason;

e. Claims for damages, other than to the work itself, because of injury to, or destruction of tangible property, including loss of use; and

f. Claims for damages because of bodily injury or death of any person, or property damage arising out of the ownership, maintenance or use of any motor vehicle.

4.3 Delivery of Insurance

Certificates of insurance shall be delivered to ODNR no later than the date when the Contractor delivers the signed Contract to ODNR for final execution.

PART 5 - BUILDER'S RISK INSURANCE REQUIREMENTS

5.1 Type of Coverage Required

Each Contractor shall purchase and maintain Builder's Risk Insurance covering his Work at the site to its full insurable value (subject to such deductible amounts as may be required by law). This insurance shall include the interest of ODNR, the Contractor and all subcontractors in the work, shall insure against the perils of fire and extended coverage, and shall include "all risk" insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and shall include damages, losses and expenses arising out of or resulting from an insured loss, or incurred in the repair or replacement of insured property (including fees and charges of engineers, architects, attorneys and other professionals). If not covered under "all risk" insurance or otherwise provided, the Contractor shall purchase and maintain similar property insurance on portions of the work stored off the site or in transit, when such portions of the work are included in an application for payment.

5.2 Delivery of Insurance

Certificates of insurance shall be delivered to ODNR no later than the date when the Contractor delivers the signed Contract to ODNR for final execution.

PART 6 – WORKERS' COMPENSATION AND INSURANCE

6.1 Certifications Required

The Office of the Attorney General will not approve the Director of Natural Resources entering into any contract until the Ohio Bureau of Workers Compensation has certified that the corporation, partnership or person so awarded the Contract has complied with each and every condition of the Act of February 26, 1913, and of all Acts amendatory or supplementary thereto, known as the Workers' Compensation Law, Section 153.08 of the Revised Code and Section 4123.01 et seq., of the Revised Code. This provision applies excepting as to materials or apparatus furnished via common carrier and requiring no installation service.

6.2 Payment of Premiums

The Contractor shall comply with the State law known as the Workers' Compensation Act, and shall pay into the State Insurance Fund the necessary premiums required by the Act to cover all employees working on this Contract and under the control of the Contractor, and shall relieve ODNR from any costs due to accidents or other liabilities mentioned in said Act. The Contractor shall also furnish at the time of delivery of this Contract and at such other times as may be requested, the official certificate or receipt showing the payments previously referred to herein, and the Contractor shall furnish proof as required that adequate compensation insurance is provided.

6.3 Subcontractor's Responsibilities

If the Contractor sublets any of the work on this Contract, the subcontractor shall be required to procure and maintain during the life of such subcontract Workers' Compensation and insurance for all of the subcontractor's employees engaged upon the work, unless they are covered by the compensation insurance of the prime contractor.

PART 7 - SUMMARY OF DOCUMENTS REQUIRED TO EXECUTE CONTRACT

7.1 Contract Documents

In order to help assure the execution of the Contract within the required time period, the lowest responsive and responsible bidder must furnish all of the following documents to ODNR within thirty (30) calendar days following the date of the notice of award of Contract:

a. Name of Insurance Companies insuring the work and the insurance certificates for both liability and builder's risk insurance as required in Parts 4 and 5 of this Section.

b. A Workers' Compensation Certificate of compliance issued by the Bureau of Employment Services, as required in Part 6 of this Section.

c. If the Contract Bond is submitted from a surety bonding company, the lowest responsive and responsible bidder shall also furnish:

   1. Credentials showing the power of attorney.

   2. A Certificate of Compliance issued by the Department of Insurance showing the right of the bonding company to do business in the State of Ohio.

   3. A financial statement of the bonding company.

d. If the lowest responsive and responsible bidder is a corporation not incorporated under the laws of the State of Ohio, there shall also be furnished a copy of a license to transact business in the State of Ohio.

e. The lowest responsive and responsible bidder must submit a valid (current) State of Ohio, Equal Employment Opportunity, EEO Certificate of Compliance, per Section 9.47 O.R.C. (See Part 2.1 of Section 00300).

f. The lowest responsive and responsible bidder must submit his Affirmative Action Plan commitment and its subcontractor(s) Affirmative Action Plan commitment(s) in writing to correct deficiencies in a pre-award compliance review, when directed by ODNR (see Part 7 of Section 00300).

g. The lowest responsive and responsible bidder and each of his subcontractors must submit, on their letterhead, dates when payments of wages to employees are to be made.

h. The lowest responsive and responsible bidder must submit with its Form of Bid a Certificate of Drug Free Workplace Compliance.

i. The lowest responsive and responsible bidder must submit with his Form of Bid an Internal Revenue Service Form W-9, Request for Taxpayer Identification Number and Certification.

j. The lowest responsive and responsible bidder must submit with its Form of Bid a signed copy of the Commitment to Participate in the EDGE Business Enterprise Program, with either Option A or Option B selected (see Section 00500).

k. The lowest responsive and responsible bidder must submit with its Form of Bid a signed copy of the Proposed EDGE Certified Business Enterprise Participation form and the Demonstration of Good Faith Effort documentation, when applicable (see Section 00500).

l. The lowest responsive and responsible bidder must sign two (2) copies of the Contract and return both copies to ODNR.

m. The lowest responsive and responsible bidder must submit a fully completed and signed *Declaration Regarding Material Assistance/Nonassistance To A Terrorist Organization* form (HLS 0038), in accordance with Section 2909.33 of the Ohio Revised Code.

7.2 Pre-Construction Documents

Within sixty (60) days following the opening of the Bids, the lowest responsive and responsible bidder shall furnish the following submittals to ODNR for approval:

a. Construction Progress Schedule

The General Trades Contractor shall be responsible for developing and maintaining

the construction progress schedule. The General Trades Contractor shall coordinate with other prime contractors, as necessary, by integrating the schedule of work of all contractors into one progress schedule. The progress schedule shall show the critical path necessary to complete the work of all contractors by the date of completion.

b. Letter of Intent to Contract and to Perform (EDGE)

The Contractor shall submit a fully-completed Letter of Intent to Contract and to Perform for each EDGE-certified business enterprise (subcontractors and material suppliers) to be used on the project. By doing so, the Contractor certifies that it intends to enter into a contract with the EDGE-certified business enterprise for the portion of the contract described in earlier submittals. The prime contractor and each subcontractor/material supplier must sign this document to confirm the agreement between the parties (see Section 00500). No departure from this list shall be made by the Contractor without the prior approval of ODNR.

c. Subcontractor and Material Supplier Declaration Form

The Contractor shall submit a list of all subcontractors and material suppliers on the project. This list shall include the company name, street address, city, state, zip code, area code/telephone number, the Federal Tax Identification Number of each proposed subcontractor, the nature of their work, the Bid Schedule item number(s) associated with their work, and the approximate dollar value of each of their subcontracts. The Contractor shall list the starting month/year for each subcontractor, the completion date for their portion of the work, and shall also designate the percentage of the total Contract to be completed by subcontractor(s) and to be performed by the Contractor's own forces (see Part 5 of Section 00100). The Contractor shall list the brand name and the type of material supplied by each individual material supplier who will be directly billing the Contractor for materials to be incorporated into the project. No departure from this list shall be made by the Contractor without the prior approval of ODNR.

If ODNR has reasonable objection to any proposed subcontractor, ODNR will promptly notify the Contractor and will state the reasons for the objection. ODNR reserves the right to reject any subcontractor if said subcontractor is determined to be inexperienced, inferior in quality of workmanship, or if the conduct and performance of the subcontractor on a previous contract was generally unsatisfactory; this shall include, without limitation, compliance with Equal Employment Opportunity in the Construction Industry and/or prevailing wage laws.

If ODNR has reasonable objection to any proposed material supplier, ODNR will promptly notify the Contractor and will state the reasons for the objection. ODNR reserves the right to reject any supplier, if said supplier is determined to be inexperienced, inferior in quality of workmanship, or the conduct and performance of the supplier on a previous contract was generally unsatisfactory.

d. Division of Contract

A division of Contract must be prepared for each lump sum bid item over $10,000.00 on the form supplied by ODNR. The Division of Contract breaks down the overall labor and material lump sum prices into labor and material prices for each of the various work items involved in the lump sum work. The totals for the various work items must add up to the total lump sum price bid for each item.

No right to payment shall accrue if these Pre-Construction documents are not submitted in a timely fashion.

PART 8 – NOTICE TO PROCEED

8.1 Issuing the Notice to Proceed

A written Notice to Proceed will generally be issued by ODNR within sixty (60) days following the opening of bids, and the Contractor must begin work within ten (10) days following receipt of the Notice to Proceed. The Contractor must complete all work on the project between the date of the Notice to Proceed and the specified contract completion date.

8.2 Multiple Prime Contracts

On projects with multiple prime contracts, each prime contractor will usually have an identical Notice to Proceed date. It shall be the responsibility of the designated lead contractor (the General Contractor unless otherwise specified in the contract documents), to develop a single Construction Progress Schedule for all of the work, set the pace of the work, and coordinate the work of any and all other prime contractors working at the site.

PART 9 – FORM OF CONTRACT

A sample form of the Contract to be signed is attached to the end of this section.

END OF SECTION

DIVISION OF ENGINEERING
C O N S T R U C T I O N C O N T R A C T

THIS AGREEMENT made and entered into this _____ day of _____, 2011, by and between Contracts name and complete address as seen on the Form of Bid hereinafter referred to as the "Contractor," and the State of Ohio, acting by the Department of Natural Resources, 2045 Morse Road, Building E-3, Columbus, Ohio 43229-6693, party of the second part, hereinafter referred to as "ODNR."

WITNESSETH, that the said Contractor, for the consideration stated herein, hereby agrees as follows:

The Contractor, under the direction and to the satisfaction of the Director of the Department of Natural Resources, hereinafter referred to as the "Director", shall and will provide all necessary materials, tools, equipment, utility and transportation services, and perform all labor necessary to complete, in a satisfactory manner, all the work for:

PROJECT LOCATION
PROJECT NAME
COUNTY, OHIO
PROJECT NO. DNR –XXXXXX

ALL IN STRICT accordance with the plans, drawings, specifications, addendum number(s) __and Form of Bid on file in the Division of Engineering, Department of Natural Resources, 2045 Morse Road, Building E-3, Columbus, Ohio 43229-6693, prepared by:

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENGINEERING
2045 MORSE ROAD, BLDG. E-3
COLUMBUS, OHIO 43229-6693

which plans, drawings, specifications, and form of bid are expressly made an essential part of this contract.

THE CONTRACTOR shall complete all work contemplated under this contract by COMPLETION DATE in accordance with the construction schedule established in the specifications.

Should the Contractor, due to his own reasons or fault, neglect, fail, or refuse to complete the work embodied in this contract by the date above-mentioned, then the Contractor shall pay to ODNR, as liquidated damages for breach of contract, the sum of IN PART 26, SECTION 26.2 for each and every calendar day that said work remains in an unfinished condition beyond the date specified above for completion.

The ODNR, for and in consideration of the true and faithful performance of said work and the furnishing of said materials as aforesaid, hereby agrees to pay to the Contractor, the approximate sum of Dollar amount written out ($185,190.67). The actual sum paid under this contract will be the aggregate total determined by the work actually performed by the Contractor, calculated upon the following unit or lump sum prices as set out in this agreement and any modifications by Change Order, as agreed upon by the Contractor and ODNR.

WHEREAS, funds for paying for said services rendered have been released by the Controlling Board on _____, 2011 and have been encumbered by Purchase Order Number _____, and are so certified by the Director of Budget and Management on _____, 2011 in accordance with the provisions of Section 126.07 of the Ohio Revised Code.

The parties for themselves, their heirs, executors, administrators, and assigns, do hereby agree to the full performance of the covenants herein contained.

Section 153.59 - that, in the hiring of employees for the performance of work under the contract or any subcontract, no contractor, subcontractor or any person acting on a contractor's or subcontractor's behalf, by reason of race, creed, sex, disability or military status as defined in section 4112.01 of the Revised Code, or color, shall discriminate against any citizen of the state in the employment of labor or workers who is qualified and available to perform to which the employment relates. For any violation, the Contractor shall suffer such penalties as provided for in Section 153.60, Ohio Revised Code.

The Contractor shall comply fully with the provisions of Section 4115.03 through Section 4115.16 of the Ohio Revised Code and Administrative Rule 4101:9-4-01 through 4101:9-4-28 of the Department of Administrative Services.

The Contract Documents embody the entire understanding of the parties and form the basis of the Contract between the Department of Natural Resources and the Contractor. The Contract Documents shall be considered to be incorporated by reference into this Contract as if fully rewritten herein.

The Contractor certifies that the Contractor is not a public employee under Federal or State law for tax, worker's compensation or retirement deduction purposes, and that it carries worker's compensation coverage.

The Contractor agrees to comply with all applicable State and Federal laws regarding drug-free workplace. The Contractor shall make a good faith effort to ensure that all Contractor employees, while working on State property, will not purchase, transfer, use or possess illegal drugs or abuse prescription drugs in any way.

In accordance with Section 9.24 of the Ohio Revised Code, ODNR is prohibited from awarding a contract for goods, services, or construction, paid for in whole or in part with state funds, to a person or company against whom a finding for recovery has been issued by the Auditor of State, if the finding for recovery is unresolved. Prior to execution of this contract, ODNR shall verify the Contractor's compliance with the requirements of Section 9.24.

The Contractor warrants that is not subject to an unresolved finding of recovery under Section 9.24 of the Ohio Revised Code. If the warranty is deemed to be false, the Contract is void *ab initio* and the Contractor must immediately repay the State any funds paid under this Contract.

This project is subject to the State of Ohio, Encouraging Diversity, Growth, and Equity (EDGE)

business development program. The Contractor agrees to comply with the requirements of Section 123.152 of the Ohio Revised Code and Administrative Rule 123.2-16-08 of the Department of Administrative Services.

The Contractor by signature on this document, certifies that it: (i) has reviewed and understands the Ohio ethics and conflict of interest laws as found in Ohio Revised Code Chapter 102 and in Ohio Revised Code Sections 2921.42 and 2921.43, and (ii) will take no action inconsistent with those laws. The Contractor understands that failure to comply with Ohio's ethics and conflict of interest laws is, in itself, grounds for termination of this Agreement and may result in the loss of other contracts or grants with the State of Ohio.

The contractor affirms that, as applicable to it, no party listed in Division (I) or (J) of Section 3517.13 of the Ohio Revised Code or spouse of such party has made, as an individual, within the two previous calendar years, one or more contributions totaling in excess of $1,000.00 to the Governor or to his campaign committees.

IN WITNESS WHEREOF, THE PARTIES HERETO HAVE HEREUNTO SET THEIR HANDS ON THE DAY AND YEAR FIRST ABOVE MENTIONED.

As Signers Title as seen on Form of Bid

Of Company Name as on Form of Bid
(I, We) have the authority to sign this contract and do so in (My, Our) respective capacities:

_____

XX-XXXXXXX
Federal Tax I.D. Number

Approved as to form:

Mike DeWine
Attorney General

By _____
Assistant Attorney General

Date_____

STATE OF OHIO
Acting By

Department of Natural Resources

BY _____
DIRECTOR

Date_____

Revised 3/11

APPENDIX A: STATE EQUAL EMPLOYMENT OPPORTUNITY COVENANT

(FOR STATE CONSTRUCTION CONTRACTS)

During the performance of this contract, the contractor further agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, ancestry or sex. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, national origin or sex. Such action shall include, but is not limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, ancestry, or sex.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the contracting officer, advising the labor union or workers' representative of the contractor's commitments under Section 202 of the Director of Department of Public Worker Works' Rule and Regulation on Equal Employment Opportunity (hereinafter referred to as "DPW Regulation on EEO") and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of the DPW Regulation on EEO, and of the Implementing Rules, Regulations, and applicable orders of the State Equal Employment Opportunity Coordinator.

(5) The contractor agrees that he will fully cooperate with the State Equal Employment Opportunity Coordinator, with any other official or agency of the State or Federal Government which seeks to eliminate unlawful employment discrimination, and with all other State and Federal efforts to assure equal employment practices under this contract, and said contractor shall comply promptly with all requests and directions from the State of Ohio or any of its officials and agencies in this regard, both before and during performance.

(6) Full cooperation as expressed in clause (5), above, shall include, but, not be limited to, being a witness and permitting employees to be witnesses and complainants in any proceeding involving questions of unlawful employment practices, furnishing all information and reports required by the DPW Regulation on EEO, and by the rules, regulations, and orders of the State Equal Employment Opportunity Coordinator pursuant thereto, and permitting access to its books, records, and accounts by the Contracting Agency and the State Equal Employment Opportunity Coordinator, for such purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further State Contracts in accordance with procedures authorized in the DPW Regulation

on EEO, and such other sanctions may be imposed and remedies instituted as provided in said Regulation or by rule, regulation, or order of the State Equal Employment Opportunity Coordinator, or as otherwise provided by law.

In the event this contract is terminated for a material breach of said Regulation, the contractor shall become liable for any and all damages which shall accrue to the State of Ohio as a result of said breach.

(8) The Contractor will include the provisions of Paragraph (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the State Equal Employment Opportunity Coordinator issued pursuant to Section 204 of the DPW Regulation on EEO, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the Contracting Agency may direct as a means of enforcing such provisions including sanctions for noncompliance; provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor, vendor or other party as a result of such direction by the contracting agency, the contractor may request the State of Ohio to enter such litigation to protect the interest of the State.

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ENCOURAGING DIVERSITY, GROWTH, AND EQUITY
(EDGE)

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SECTION 00500
ENCOURAGING DIVERSITY, GROWTH, AND EQUITY (EDGE)SECTION 00100

PART 1 - ATTENTION ALL BIDDERS

1.1 Importance of this Section

In accordance with the requirements of Section 123.152 of the Ohio Revised Code and Section 123:2-16-08 of the Ohio Administrative Code, this project is subject to the requirements of the Encouraging Diversity, Growth, and Equity (EDGE) business development program. Certain EDGE requirements must be met in order for your Bid to be considered responsive and responsible. Failure to comply with these requirements may cause your Bid to be rejected as non-responsive.

1.2 EDGE Participation Goal

An EDGE Participation Goal of **5.0%** of the total contract amount has been established for this project, in accordance with the goal setting process established in Section 123:2-16-08 of the Ohio Administrative Code. Bidders must demonstrate actual participation in the EDGE program, through utilization of EDGE-certified subcontractors and material suppliers, to reach or exceed this goal or provide documentation of their good faith effort to reach this goal (see Part 3).

PART 2 – BIDDING REQUIREMENTS

2.1 Summary of Required Bidder Actions

All Bidders are required to submit with their bid the Commitment to Participate in the EDGE Business Enterprise Program form included with the bidding package. The Bidder must select either Option A or Option B, and also provide the necessary documentation required by each option:

Option A - Bidders who will meet or exceed the Participation Goal:

- Bidders who will meet or exceed the stated EDGE Participation Goal must also submit the Proposed EDGE Certified Business Enterprise Participation form in their bidding package. This form identifies the proposed EDGE-certified subcontractors and material suppliers that will be utilized under this construction contract.
- If selected for consideration as the lowest responsive and responsible bidder, a Letter of Intent to Contract and Perform form for each EDGE-certified subcontractor and material supplier to be used on this project must be submitted within **five (5) business days after notification by ODNR.** This form must be signed and dated by both the prime contractor and subcontractor or material supplier that will be put under contract to perform on a portion of the project.

Option B - Bidders who are not able to meet the full Participation Goal:

- Bidders who are not able to meet the stated EDGE Participation Goal but will provide a lesser percentage of the total contract amount must state on the form the percentage of the proposed contracted amount that will utilize EDGE-certified

subcontractors and material suppliers.

- Bidders who are not able to meet the stated EDGE Participation Goal must submit the Proposed EDGE Certified Business Enterprise Participation form in their bidding package. This form will identify the proposed EDGE-certified subcontractors and material suppliers that will be utilized under this construction contract.
- Bidders who are not able to meet the stated EDGE Participation Goal must submit a detailed Demonstration of Good Faith document in their bidding package. This document describes the Bidder's efforts undertaken prior to the Bid Opening to meet the stated EDGE Participation Goal (see Part 3).
- If selected for consideration as the lowest responsive and responsible bidder, a Letter of Intent to Contract and Perform form for each EDGE-certified subcontractor and material supplier to be used on this project must be submitted within **five (5) business days after notification by ODNR.** This form must be signed and dated by both the prime contractor and subcontractor or material supplier that will be put under contract to perform on a portion of the project.

Option B - Bidders with no EDGE-certified participation in the project:

- Bidders who are not able to meet ANY PORTION of the EDGE Participation Goal outlined in this section must submit a detailed Demonstration of Good Faith document in their bidding package. This document describes the Bidder's efforts undertaken prior to the Bid Opening to meet the stated EDGE Participation Goal (see Part 3).

2.2 Failure to Comply

Failure of the Bidder to provide the information requested in Part 2.1 within the specified timeframes may cause your Bid to be rejected as non-responsive.

PART 3 – DEMONSTRATION OF GOOD FAITH EFFORT

3.1 Good Faith Effort

All Bidders selecting Option B on the Commitment to Participate in the EDGE Business Enterprise Program form must submit in writing, on company letterhead, a detailed Demonstration of Good Faith Effort that details their efforts to meet the EDGE Participation Goal prior to bid opening and requests a waiver of the EDGE Participation Goal by ODNR. To receive a waiver, the Bidder shall submit evidence demonstrating that the Bidder made the level of good faith effort deemed necessary to justify the granting of a waiver.

3.2 Demonstration of Good Faith Efforts

Actions undertaken by the Bidder to demonstrate a good faith effort to meet or exceed the EDGE Participation Goal include, but are not limited to, the following:

- The Bidder utilized reasonable and available means to solicit all EDGE-certified business enterprises that have the capability to perform work under the contract.

- The Bidder selected portions of the contracted work that would increase the likelihood of participation by EDGE-certified business enterprises.

- The Bidder provided all appropriate EDGE-certified business enterprises with adequate information about the plans, specifications and requirements of the contract in time for EDGE-certified business enterprises to provide price quotations for the project.

- The Bidder negotiated in good faith with interested EDGE-certified business enterprises. To demonstrate good faith effort negotiations, the Bidder shall provide evidence of such negotiations, including but not limited to names, addresses, dates, and telephone numbers of the EDGE-certified business enterprise considered.

- The Bidder properly rejected an interested EDGE-certified business enterprise as being unqualified for the work of the contract. Rejection of an EDGE -certified business enterprise based on standing within appropriate industry or membership or affiliation in a business, social or political group IS NOT a basis for rejection.

- The Bidder utilized the services of one or more organizations that provide contractor assistance in the identification and recruitment of EDGE-certified business enterprises.

- The Bidder utilized the list of qualified EDGE-certified business enterprises as provided by the Equal Employment Opportunity Division of the Department of Administrative Services, **www.EDGE.ohio.gov**.

3.3 Evaluation of Good Faith Effort

ODNR shall evaluate the Demonstration of Good Faith Effort documentation after opening of bids and may use this evaluation in the determination of the lowest responsive and responsible bidder. Any waiver of the stated EDGE Participation Goal issued by ODNR as a result of an approved Demonstration of Good Faith Effort will be provided to the lowest responsive and responsible bidder in writing.

PART 4 -– CONSTRUCTION CONTRACT REQUIREMENTS PROJECT TIMETABLE

4.1 Subcontractor & Material Supplier Declaration Form

In accordance with Part 7 of Section 00400 **Execution of the Contract**, the Contractor must complete and submit to ODNR a Subcontractor & Material Supplier Declaration Form. ODNR will review this information against the Commitment to Participate in the EDGE Business Enterprise Program, Letter of Intent to Contract and Perform, and Demonstration of Good Faith Efforts for proper utilization of Edge-certified subcontractors and material suppliers, as outlined in contract documents.

4.2 EDGE Participation - Affidavit of Contractor Form

Throughout the life of the project, the Contractor must submit along with each monthly pay estimate a copy of the Affidavit of Contractor Payment Form for each EDGE-certified subcontractor and material supplier receiving payment from the previous month's approved pay request. ODNR will use the collected data to verify the Contractor's compliance with their approved Letter of Intent to Contract and Perform and Demonstration of Good Faith Efforts, help establish an agency EDGE procurement goal,

and to determine the overall effectiveness of the EDGE program.

4.3 EDGE Participation Final Report

The Contractor shall provide a certified Affidavit of Contractor Final Report for payments made to each EDGE-certified subcontractor and material supplier that participated on this Contract. This report shall include, but not be limited to, the following items:

4.3.1 Name of each EDGE-certified business;
4.3.2 Original amount of the EDGE-certified business contract or purchase order with the Contractor;
4.3.3 Current amount of the EDGE-certified business contract or purchase order;
4.3.4 The amount invoiced to date;
4.3.5 The amount paid to date; and
4.3.6 A statement describing any substantive product or performance deficiencies.

This report must be submitted along with the Contractor's Final Pay Request, in accordance with Part 34 of Section 01000. Failure to submit this report may delay final payment and closeout of the Contract.

END OF SECTION

STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENGINEERING

LETTER OF INTENT TO CONTRACT AND PERFORM

The apparent low bidder shall complete and submit one form for each EDGE-certified Business Enterprise to be utilized on the project.

Project Name: _____

ODNR Project Number: _____

A. EDGE-certified Business Enterprise (for project contract at ANY tier).

EDGE-certified business: _____

Address: _____

_____

Federal Tax Identification Number: _____

Telephone: (____) _____ Fax Number (____) _____

B. Briefly describe services, work, or supplies to be provided.

_____

_____

The undersigned Bidder certifies their intent to use the above-referenced EDGE-certified Business Enterprise for the services described above related to this project, and the undersigned EDGE-certified Business Enterprise certifies their intent to provide the work described above for the estimated cost of

$ _____, which is approximately _____ % of the total contract amount.

This document does not serve as a contract between the Bidder and the Edge-certified Business Enterprise, and in the event the Bidder is not awarded the contract this Letter of Intent shall be considered null and void.

Bidder Company Name: _____

Authorized Signature / Date: _____

EDGE-certified Business Name: _____

Authorized Signature / Date: _____

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SECTION 01000
GENERAL CONDITIONS

PART 1 - DEFINITION OF TERMS

Whenever used in the Contract Documents, the following words, whether used in the singular or plural, or in a tense other than that employed in this list, mean:

ADDENDA - Written and/or graphic instruments, issued prior to the opening of Bids, which clarify, correct, or change the Contract Documents.

AMENDMENT – A written and/or graphic instrument which modifies the Contract Documents for the purpose of rebidding the project.

APPLICATION FOR PAYMENT - See "Contractor's Estimate".

APPROVED EQUAL - Meets or exceeds the specified standard, and is approved in writing by the Chief Engineer or a representative of the Division of Engineering.

CHANGE ORDER - A written order to the Contractor authorizing a change in the work, an adjustment in the Contract Price, and/or an adjustment in the Contract Completion Date.

CHIEF ENGINEER - The Chief Engineer of the Ohio Department of Natural Resources, acting as the authorized representative of the Ohio Department of Natural Resources.

CONTRACT DOCUMENTS - The Contract, Amendment, Addenda, the Bid, including all documents accompanying the Bid Package and all post-Bid documentation submitted prior to execution of the Contract, all the Bonds, the Instruction to Bidders Section, the Wages and Hours Requirements Section, the Affirmative Action/ Equal Employment Opportunity (EEO) Requirements Section, the Execution of the Contract Section, the General Conditions, the General Specifications, the Special Provisions and the Detailed Specifications, the Drawings, and all Modifications issued after the Execution of the Contract.

CONTRACT DRAWINGS - All tracings, drawings, or reproductions thereof furnished by ODNR pertaining to the Project and such detailed drawings as may be issued by ODNR as the work progresses.

CONTRACTOR'S PAY ESTIMATE - The form designated by ODNR to be used by the Contractor in requesting payment, and which shall be supplemented by all supporting documentation required by the Contract Documents.

DAY - A calendar day of twenty-four hours, measured from midnight to the next midnight.

DEDUCTION - A form of Change Order to the Contractor authorizing a revision to the scope of work resulting in a deletion of work.

DIRECTOR - The Director of the Ohio Department of Natural Resources or his authorized representative.

EXTRA - A form of Change Order authorizing a revision resulting in an addition to the work.

FIELD ORDER - A written instrument, on a form utilized by ODNR and delivered to the Contractor, which interprets and/or provides the Contractor with information clarifying a particular requirement of the Contract Documents. A field order must always be signed by the Contractor to acknowledge receipt, and the Contractor must always carry out the work or direction noted therein.

GENERAL TRADES CONTRACTOR - The Contractor having Contract I for this project is designated as the General Trades Contractor, who is responsible for setting the pace of the work and coordinating the work of any and all other prime contractors working at the site.

LABOR COSTS - The cost of installing the materials delivered to the site, including the cost of tools, fuels, power costs, etc. associated with installing the materials included in the bid schedule or approved Change Orders.

MATERIAL COSTS - The cost for supplies, including freight and storage costs, delivered to the site as included in the bid schedule or approved Change Orders. Materials shall be only those materials to be incorporated into the project.

MODIFICATION - A written amendment to the Contract Documents created after the contract is signed.

NOTICE TO PROCEED - A written notice mailed by ODNR to the Contractor instructing the Contractor to commence work.

ODNR - The Ohio Department of Natural Resources, Division of Engineering, 2045 Morse Road, Building E-3, Columbus, Ohio 43229-6693, Phone (614) 265-6948.

ODNR PROJECT MANAGER - The authorized employee of the Division of Engineering, Ohio Department of Natural Resources specifically assigned to represent ODNR at the site of the work.

PLANS - Same definition as "Contract Drawings".

PROGRESS SCHEDULE - The detailed schedule that illustrates the work of all contractors for each and every stage of the construction within the specified time for completion of the - Project and reflects the critical path of construction.

RESIDENT PROJECT REPRESENTATIVE (RPR) - The authorized representative of a consulting engineer/architect under separate contract with ODNR to be present upon the site of the work.

SHOP DRAWINGS - All drawings, diagrams, illustrations, cut sheets, color charts, samples, schedules, and other information specifically prepared by the Contractor, a subcontractor, a manufacturer, a fabricator, a supplier, a distributor or other entity authorized by, and acting on behalf of the Contractor, to illustrate some portion of the work, required or requested to be submitted by the Contractor to the Division of Engineering for approval.

SPECIFICATIONS - Those portions of the Contract Documents consisting of written technical descriptions of, and requirements applicable to materials, equipment, construction systems, standards and workmanship as applied to the work, and all administrative details, procedures and requirements. Specifications include all Divisions herein.

SUBCONTRACTOR - A person or entity who has a direct contract with the Contractor to perform any of the work at the site.

SUBSTANTIALLY BEHIND SCHEDULE - The Contractor shall be considered to be substantially behind schedule if any of the following conditions exist: the Contractor is only 25% complete when the construction progress schedule reflects that he should be 50% complete; the Contractor is only 50% complete when the construction progress schedule reflects that he should be 90% complete; or the Contractor is only 75% complete when the construction progress schedule reflects that he should be 100% complete. The above percentages shall be in terms of construction costs.

SURETY - The corporate body which is bound with and for the Contractor and which engages itself to be responsible for the acceptable performance of the project and for payment of all debts pertaining to the project.

STATE, THE - The State of Ohio, Department of Natural Resources.

WINTER - That period of time between November 15 and March 15.

WORK - The construction services required by the Contract Documents, to include all labor, materials, equipment, and services performed or provided by the Contractor for the project.

PART 2 - INTENT AND USE OF THE CONTRACT DOCUMENTS

2.1 Relationship between Documents

The Contract Documents comprise the entire Contract between ODNR and the Contractor concerning the work. They may be altered only by a written modification. The specifications are accompanied by construction drawings that are duplicates of drawings on file in the Division of Engineering, Department of Natural Resources

The Contract Documents are complementary; what is called for by one part is as binding as if called for by all parts. The table of contents, titles and headings contained in the Contract Documents are solely to facilitate reference to pertinent provisions of the Contract Documents, and shall in no way affect the interpretation of the provisions to which they refer. Further, in the event any particular part of these Contract Documents is found to be unenforceable, no such event shall affect the enforceability or applicability of any other part of the Contract Documents.

In the event a conflict between the Drawings and the Specifications arises, the Contractor shall notify ODNR, who shall interpret and rule on the true intent.

2.2 References to Other Documents

Reference to standard specifications, manuals or codes of a technical society, organization or association, or to the code of a governmental authority, whether such reference is specific or by implication, shall mean the latest standard specification, manual or code in effect at the time of opening of the Bids unless otherwise specifically stated and shall be as binding as other project specifications. However, no provision of a referenced standard specification or manual (whether or not specifically incorporated by reference in the Contract Documents) shall change the duties or responsibilities of ODNR, the Contractor or

any of their agents or employees from those set forth in the Contract Documents.

2.3 Contract Document Ownership

Neither the Contractor nor a subcontractor, manufacturer, fabricator, supplier or distributor shall have or acquire title to or ownership rights in the Contract Documents.

2.4 Intent of the Contract Documents

It is the intent of the Contract Documents, Contract Specifications, and Drawings together to describe the complete project. All work that may be reasonably inferred from the Contract Documents as being required to produce a complete and functional result shall be supplied whether or not it is specifically mentioned. When words that have a well-known technical or trade meaning are used to describe the work, materials or equipment, in all cases those words shall have that meaning.

PART 3 – CONTRACTOR'S OBLIGATION TO PERFORM

The Contractor's obligation to perform and complete the work in accordance with the Contract Documents shall be absolute. No payment, act or statement by ODNR or by an employee or agent of ODNR for the duration of the Contract shall constitute an acceptance of work not in accordance with the Contract Documents.

The Contractor agrees that work shall be prosecuted regularly, diligently, and without interruptions at such a rate of progress as will ensure full completion within the time specified. It is expressly understood and agreed, by and between the Contractor and ODNR that based upon the contract price, the time for the completion of the work is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual conditions prevailing in the locality of the work.

By executing the Contract, the Contractor represents that he has visited the site, familiarized himself with the local conditions under which the work is to be performed, and has correlated his observations with the requirements of the Contract Documents.

PART 4 - CONSTRUCTION PROGRESS SCHEDULES

It is understood and mutually agreed, by and between the Contractor and ODNR, that the date for completion as specified in the Contract Documents is an essential condition of this Contract; and it is further mutually understood and agreed that the Contractor shall be prepared to begin the work embraced in this Contract within ten (10) days following the issuance of the Notice to Proceed.

If the Contractor falls behind schedule, he must accelerate the work sufficiently to bring the work back on schedule within a two-week period after written notice to do so. Should the Contractor fail to bring the project back on schedule, ODNR may:

a. reduce, delay or withhold payments until work has been resumed according to schedule, or

b. After written notice that the work is substantially behind schedule (see definition), exercise ODNR's right to invoke either Part 30 or Part 31of the General Conditions,

whichever ODNR may deem appropriate.

Delays to other contractors working at the project site caused by one contractor shall not subject ODNR to any responsibility for payment of extra compensation to any such contractor.

PART 5 - CONFERENCES AND CORRESPONDENCE

5.1 Pre-Construction Conference

As soon as practical after execution of the Contract, a pre-construction conference will be scheduled to review and accept or modify the Contractor's proposed construction schedule, verify or clarify procedures for handling Shop Drawings and other submittals, explain the procedure for processing Contractor's Estimate Forms, and establish a general understanding among all persons who will be engaged in the construction activities. This conference shall be attended by responsible individuals, representing ODNR, the Contractor and the Contractor's subcontractors. ODNR shall designate the time, date and place for this conference.

5.2 Job Meetings

Each prime Contractor shall also attend, during the course of construction, regularly held job meetings at the job site. The frequency of these regularly scheduled job meetings will be determined by ODNR but will not occur more often than once per week.

5.3 Correspondence to the Contractor

Whenever a provision of the Contract Documents requires the giving of written notice, it shall be deemed to have been validly given if mailed by regular mail to the firm's latest address on record at ODNR, or delivered in person to an agent of the firm, or to an officer of the corporation of whom, or which the notice is given.

5.4 Correspondence to ODNR

All correspondence from the Contractor shall be sent to the Chief Engineer at the address on the Contract, and copied as otherwise noted by ODNR.

PART 6 - COMMENCEMENT OF CONSTRUCTION ACTIVITIES

6.1 When the Work May Begin

The Contractor may not commence work at the site until he has received a written notification from ODNR. The Contractor must be prepared to commence work within ten (10) days following receipt of the Notice to Proceed.

6.2 Commencement of Each Part or Stage of the Work

Before undertaking each part or stage of the work, the Contractor shall carefully study and compare the Contract Documents, checking and verifying pertinent information given, and shall also check all applicable field measurements. The Contractor shall promptly report in writing to ODNR each conflict, error or discrepancy that the Contractor may discover.

PART 7 - COORDINATION OF THE WORK

7.1 Responsibility of the General Trades Contractor

It shall be the responsibility of the General Trades Contractor (Contract 1) to set the pace of the work and coordinate the work of any and all other prime contractors working at the site. The cost associated with those efforts shall be incorporated into the various bid prices for the General Trades Contractor's work.

This coordination shall include sufficient notifications of each of the other prime contractors when they must be at the site to initiate portions of their work. These notifications should be logged by the General Trades Contractor in a construction logbook.

7.2 Coordination between Contractors

All contractors shall carry on, coordinate, and complete their work, so that the entire project will be accomplished in the scheduled manner and all work of all contracts will be fully completed on or before the date stipulated in the Form of Bid.

If any Contractor is delayed in his work because of the lack of progress, lack of cooperation or lack of coordination by another contractor at the site, the Contractor being delayed should, within five (5) days following the delay, so notify the Contractor causing the delay in writing stating the reasons why the firm is being delayed and should also send a copy of the correspondence to ODNR. For further information, refer to Part 4, Part 26 and Part 27 of Section 01000.

Each Contractor shall afford other contractors and utility companies reasonable opportunity for the introduction or storage of their materials and the execution of their work. Any Contractor failing to do so shall be responsible for all damages or other costs associated with delays in the work precipitated by such failure. For further information, refer to Part 30 of these Conditions. If ODNR is performing work with ODNR employees, the Contractor must provide reasonable opportunity to ODNR for the introduction and storage of materials and equipment and the execution of work. The Contractor shall properly connect and coordinate his work with the work of all other forces at the site.

7.3 Inspection of Work Performed by Other Forces

If any part of a Contractor's work is preceded by the work of ODNR, utility companies or any other Contractor, he shall, prior to the initiation of his work, inspect such other work and report to ODNR any defects which render it unsuitable as related to his work. Failure by any Contractor to make such inspection shall constitute his acceptance of the other work as fit and proper for the reception of his work, except as to hidden defects or defects which may develop in the other work at a later date.

The Contractor shall do all cutting, fitting, and patching of his work that may be required to properly integrate it with work performed by other forces. The Contractor shall not endanger any work of others by cutting, excavating or otherwise altering such work, and shall only cut or alter such work with the consent of the entity whose work will be affected.

PART 8 - QUALITY OF MATERIALS AND WORKMANSHIP

8.1 General Requirements

All materials and equipment furnished under this contract shall be as specified or required, or in the absence of particular specifications, shall be the best of their respective kinds, of new stock, unused and not deteriorated, and all work contemplated and described shall be done in a good, substantial and workmanlike manner and shall be of the best quality. If required by ODNR, the Contractor shall furnish satisfactory evidence to ODNR as to the kind and quality of materials and equipment.

All materials supplied under this contract, prior to installation, shall be subject to the submittal review process for purpose of determining the suitability of the material to meet its intended use. Therefore, the Contractor shall use caution in the ordering of materials (from quarries or other suppliers) to insure the materials delivered to the site are to the satisfaction of ODNR.

All equipment, which is proposed to be used on the work, shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the project shall be such that no injury to roadways, adjacent property, or other highways will result from its use.

8.2 Correction of Defective Work or Materials

The Contractor shall promptly correct all work or materials rejected by ODNR as damaged, defective, unsuitable for their intended use, or as otherwise failing to conform to the Contract Documents. The Contractor shall bear all costs of correcting such rejected work, including any costs for any additional engineering and testing services made necessary thereby, and including any costs for the removal and replacement of work previously performed by other contractors either damaged by said defective work or required to be removed to correct said defective work. The Contractor may also be required to submit shop drawings or other information as ODNR may require regarding how the work will be corrected.

If the Contractor shall neglect or refuse to remove or replace defective work or materials within seven (7) days from the date of the written notice from ODNR to do so, ODNR may then remove or cause the same to be removed and satisfactorily replaced by contract or otherwise, as ODNR may deem expedient, and may, and is empowered to, charge the expenses thereof (as outlined in the previous paragraph) to the Contractor (see Part 25 of Section 01000). The expense so charged will be deducted and paid by ODNR out of such moneys as are or may become due under this agreement; or, if such moneys are not sufficient to meet said expense, the additional moneys shall be furnished by the Contractor. If the Contractor refuses or neglects to provide the necessary moneys, they shall be provided by his surety.

PART 9 - UNCOVERING OF WORK

9.1 Uncovering Work Requiring Prior Inspection

If any portion of the work should be covered contrary to the prior request of ODNR or to

requirements specifically expressed in the Contract Documents, it must, if required in writing by ODNR, be uncovered for observation and shall be replaced at the Contractor's expense.

9.2 Uncovering Work Not Requiring Prior Inspection

If any portion of the Work has been covered which ODNR has not specifically requested to observe prior to being covered, ODNR may request to see such work and it shall be uncovered by the Contractor. If such work is found to be in accordance with the Contract Documents, the cost of uncovering and replacement shall, by appropriate Change Order, be charged to ODNR. If such work is found not to be in accordance with the Contract Documents, the Contractor shall pay such costs unless it can be proven to ODNR that this condition was caused by ODNR or a separate contractor, in which event ODNR or the separate contractor shall be responsible for the payment of such costs.

PART 10 - CONTRACTOR'S EMPLOYEES

10.1 Detrimental or Incompetent Employees

The Contractor shall employ a qualified superintendent and only competent and skillful personnel to do the work. In the event ODNR notifies the Contractor in writing that any person on the work is, in the opinion of ODNR, disobedient, intemperate, incompetent, disorderly, or otherwise unsatisfactory, the Contractor, on receiving such notice, shall immediately dismiss such person and shall not again employ that person on any part of the work without the written consent of ODNR.

10.2 Discrimination and Intimidation

Each Contractor or Subcontractor shall agree to observe the requirements of Sections 153.59, 153.591 and 153.60 of the Ohio Revised Code as to discrimination and intimidation on account of race, color, religion, sex (including sexual harassment and sexual orientation), national origin, disability, age (40-70 years), veterans status (Vietnam era, Desert Storm/Shield, or disabled) in employment practices.

PART 11 - SUBSTITUTIONS DURING CONSTRUCTION

Subsequent to the signing of the Contract and by reason of conditions of availability, time of delivery or other elements of supply, the Contractor may offer substitutions for the standards stipulated in the Contract. The decision to accept any such offer of substitution shall however lie solely with ODNR, which will not only consider availability and time of delivery but will also consider the aesthetic value of the proposed substitution, general differences in the knowledge of the product, service history, availability, the quality, efficiency, history or performance and also any architectural, engineering, inspection, testing or administrative expenses. Any adjustments in contract price and/or contract time shall be executed by appropriate Change Order. The savings in cost which result from substitution subsequent to the signing of the contract shall accrue in major part to the advantage of ODNR.

PART 12 - QUANTITIES OF WORK

12.1 Unit Price Items

For unit price items, the quantities listed on the Form of Bid are to be considered as approximate and are to be used for the comparison of bids only. Even though the unit prices

tendered by the Contractor are tendered for the scheduled quantities, the scheduled quantities may be increased or decreased as herein provided. It is understood that the scheduled quantities of work to be performed and materials to be furnished may each be increased or diminished as hereinafter provided without in any way invalidating the unit bid prices bid for those items.

Payments for unit price items will be made to the Contractor only for actual quantities of work performed or materials furnished in accordance with the plans and specifications except that the Contractor may not exceed the unit quantities shown on the Bid Schedule without prior written approval of ODNR. Even if it is determined by the Contractor that additional unit priced quantities (above and beyond the bid schedule quantity) are required to meet plan dimensions, the Contractor shall not exceed the bid schedule quantities without prior approval of ODNR (See Part 24 of Section 01000). Quantities above and beyond the bid schedule quantity placed without prior approval of ODNR will not be paid for by ODNR.

12.2 Lump Sum Items

For lump sum payment items, payment shall not exceed the amount bid by the Contractor. The work, materials and equipment to be included in the lump sum bid price shall include all items necessary to produce a complete and properly functioning system, as intended. This shall include all connections, controls, wiring, supply lines, drain lines, etc., required to render the lump sum bid item functional as intended and able to pass all applicable codes, tests, and required inspections.

Partial payments to the Contractor for work performed under lump sum items shall be based upon a schedule of values prepared by the Contractor (The Division of Contract) and approved by ODNR, which shall apportion the lump sum price to the major components entering into or forming a part of the work under the lump sum price.

PART 13 - INTERPRETATIONS

When, during the course of the progress of the work, a question arises as to the intent of the Contract Documents, the scope of the work to be performed, the labor or materials to be supplied, or the Contractor feels that the work he is about to perform will exceed the Contract cost, such questions must, prior to the work being performed, be referred to the ODNR Project Manager for a formal determination. All such referrals must be made prior to the work being performed. Any work performed prior to such referral to the ODNR Project Manager and receipt of written instructions from him shall be considered to have been performed within the scope of the contract and performed at no cost to ODNR.

If, upon receipt of a question concerning the work, the ODNR Project Manager determines that the work referred to must be performed by the Contractor at no increase in price to the contract, the ODNR Project Manager will issue a Field Order, which upon issue must be signed by the Contractor acknowledging receipt. In the event the contractor disagrees with such an interpretation, he must register a protest by Certified Mail with the Chief Engineer within ten (10) days following the date of issuance of the Field Order by the ODNR Project Manager (See Part 18 of Section 01000). However, the Contractor must immediately proceed with the instructions given in the issued Field Order.

If, upon receipt of a question concerning the work, the ODNR Project Manager determines that the work referred to lies outside the Contractor's scope of work, he will not issue a Field Order but rather shall initiate the procedures for the execution of a Change Order. (see Part

24 of Section 01000).

Interpretations of the requirements of the Contract Documents (Field Orders) may be issued at any time during the course of the construction by the ODNR Project Manager. The Contractor, at all times, is required to immediately execute the instructions of all issued Field Orders.

PART 14 - ELIMINATION OF SHIPPED MATERIALS

If, after execution of the Contract, ODNR, by initiating a Change Order, eliminates material or equipment which requires submittal and approval of samples or shop drawings and the Contractor has received these approvals through complete and successful drawing submittals and the material has been subsequently shipped and cannot be returned to the supplier for restocking, the Contractor may claim invoiced costs of that material or equipment which is in transit or stored at the project site or other authorized and properly bonded place, and also may claim invoiced charges for freight and storage, the total claim not to exceed the cost bid for material on the Contractor's proposal for that item. Materials and equipment paid for in this way shall become the property of ODNR. If the item can be restocked, the Contractor may claim reasonable costs for freight, storage and restocking, but may not claim labor costs.

In the event such an event occurs involving materials and/or equipment in transit or in storage at the Contractor's risk (i.e. shop drawing or other submittal approval was not obtained by the Contractor through complete and successful shop drawing and/or sample submittal procedures where required by the Contract Documents), ODNR shall have the option to pay for such materials and/or equipment, thereby taking ownership, or of rejecting the claim, in which case the Contractor shall be fully and solely liable for costs and final disposition of the materials and/or equipment involved.

PART 15 - CONSTRUCTION MEANS AND METHODS

15.1 Responsibility of the Contractor

Unless otherwise expressly provided on the Contract Documents, the means, methods, techniques, sequences and procedures of construction shall be such as the Contractor may choose; subject, however, to ODNR's right to reject means and methods proposed by the Contractor which will not produce finished work in accordance with the terms of the Contract or does not meet the highest standards of workmanship of the industry. ODNR may also recommend means or methods more stringent than those proposed by the Contract in the interest of alleviating hazards of the work to persons or to property.

The approval or lack of approval by ODNR of the Contractor's means or methods of construction or ODNR's failure to exercise the right to reject such means and methods, shall not relieve the Contractor of his obligation to accomplish the result intended by the Contract Documents; nor shall the exercise of, or failure to exercise such right to reject, create cause of action for damages.

The Contractor shall be responsible to ODNR for the acts and omissions of his employees, subcontractors and their agents and employees, and other persons performing any of the Work under a Contract with the Contractor.

15.2 Contractor's Responsibility to Control Access

The Contractor shall have the right and duty to deny access to the work or parts of it to third parties at all times during construction except to third parties to inspect, certify, or observe it when required by law or the Contract Documents, or to those who require reasonable access to a particular part(s) of the work by reason of specific contractual relationship to the project or to maintain existing facilities.

The Contractor shall be responsible for providing whatever means and methods (including signs, fences, security personnel, etc.) needed to accomplish these ends.

PART 16 - SUBCONTRACTORS

16.1 Contractor's Responsibility for Subcontractors

The Contractor shall be fully responsible for all acts and omissions of his subcontractors, and of persons or organizations directly or indirectly employed by them, and of persons and organizations for whose acts any of them may be liable to the same extent that the Contractor is responsible for the acts and omissions of persons directly employed by the Contractor.

16.2 ODNR's Responsibility to Subcontractors and Material Suppliers

The Contract Documents do not create a contractual relationship between ODNR and any subcontractor or other person or organization having a direct contract with the Contractor, and they do not create an obligation on the part of ODNR to pay or to see the payment of monies due a subcontractor or other person or organization, except as may otherwise be required by law.

16.3 Agreements with Subcontractors

It is required that all work performed for the Contractor by a subcontractor must be performed pursuant to an appropriate written agreement between the Contractor and the subcontractor, which specifically binds the subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of ODNR. Said agreement must preserve and protect the rights of ODNR under the Contract Documents with respect to the work to be performed by the subcontractor so that the subcontracting thereof will not prejudice such rights, and must allow to the subcontractor, unless specifically provided otherwise in the Contractor-subcontractor agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Contract Documents, has against ODNR. The Contractor must include all required labor provisions and the State of Ohio EEO Covenant “APPENDIX A” in his agreements with subcontractors. Where appropriate, the Contractor must require each subcontractor to enter into similar agreement with his subcontractors.

Upon request of ODNR, the Contractor shall provide ODNR a copy of any contract or document between the Contractor and any subcontractor.

16.4 Encouraging Diversity, Growth, and Equity (EDGE) Requirements

The Contractor shall refer to Section 00500 of the Project Manual for reporting requirements on the use of EDGE-certified subcontractors and material suppliers.

PART 17 - RESPONSIBILITIES OF THE DIVISION OF ENGINEERING

17.1 Sole Contractual Representative of ODNR

The Division of Engineering will be ODNR's sole representative during the duration of the project. All communication from ODNR to the Contractor will be issued through the Division of Engineering and all correspondence to ODNR from the Contractor shall be addressed to the Division of Engineering with copies to parties designated by ODNR. The function of the Division of Engineering as ODNR's representative during construction is set forth throughout these General Conditions.

17.2 ODNR's Observation of the Work

The Division of Engineering will be responsible for the scheduling of visits to the site at appropriate intervals to observe the progress and quality of the various aspects of the construction work to determine, in general, if the work is proceeding in accordance with the Contract Documents. ODNR, however, will not be responsible for making exhaustive or continuous on-site inspections to check the quality or quantity of the work, nor will ODNR be responsible for the construction techniques, means, methods, sequence of construction or procedures, or the safety precautions and progress incidental to the Contractor's activities.

In the event ODNR has hired a consulting engineering or architectural firm to provide construction administration or other construction-related services for this project, the Contractor shall consider the Consultant's Resident Project Representative as the on-site representative of ODNR unless otherwise noted. When prior notifications by the Contractor are required by the Contract Documents for the observation or testing of particular work items, the Contractor shall provide such notifications to the Consultant's Resident Project Representative.

17.3 Issuance of Change Orders and Field Orders

The Chief Engineer shall be the final ODNR interpreter of the requirements of the Contract Documents and the judge of the adequacy of the work performed. The Division of Engineering will furnish, with reasonable promptness, such clarifications, explanations or interpretations of the Contract Documents as are deemed necessary. The Division of Engineering shall be the final judge as to the need for, the existence of, and the reasonableness of prices for extra work and deducted work.

No Field Orders or Change Orders can be executed by consultants hired by ODNR to provide construction administration or other construction-related services. These two forms can only be executed by the authorized employees of ODNR.

17.4 Preparation of Additional Drawings

ODNR shall furnish the Contractor further drawings as may be necessary to detail and illustrate the work to be performed and the Contractor shall immediately conform his work to said drawings and said drawings shall become a part of the Contract Documents.

17.5 Assistance Required by ODNR

The Contractor shall render all necessary assistance to the Division of Engineering and if required, shall furnish the ODNR Project Manager with measuring devices, measurements, etc., on the work or grounds.
The Contractor shall notify ODNR in writing at least seven (7) days prior to the commencement of manufacture of any equipment or materials of the time and place where the manufacture is to take place so that a representative of ODNR may be present to inspect the manufacture.

PART 18 - CLAIMS AND DISPUTES

The performance of work required under this contract shall not be delayed pending resolution of any claim or dispute between the Contractor and ODNR. The parties will attempt informally to resolve any claim or dispute, but if informal resolution is not achieved, the Contractor must set forth the basis of a claim or grounds for a dispute in writing, addressed to the Chief Engineer, not less than twenty (20) days after the occurrence of the event giving rise to the disagreement. Such written notice shall state the Contractor's position clearly and in detail, and shall include any documents or materials that the Contractor wishes ODNR to consider in reviewing the claim or dispute. The Chief Engineer shall respond in writing to the Contractor, and may, at the Chief Engineer's sole discretion, meet with the Contractor to discuss the claim or dispute. If the claim or dispute is not resolved through this process, then the Contractor may invoke the dispute resolution procedures of Section 153.12 of the Ohio Revised Code.

PART 19 - CONTRACTOR'S SUPERVISION OF THE WORK

19.1 Office Supervision

The Contractor shall devote the office attention necessary to ensure the timely submission of shop drawings and samples of materials, and to ensure that materials are ordered with sufficient lead time to be available at the site when needed to insure that the work progresses according to the progress schedule and in accordance with the Contract Documents.

The General Trades Contractor shall set the pace of the work and shall devote the office attention necessary to carry out the requirements as stated in Part 7 of Section 01000.

19.2 Field Supervision

The Contractor shall designate and keep on the project site at all times during the work a competent resident superintendent, employed by the Contractor to be present at the site full-time while the work is in progress, who shall not be replaced without notice to and approval by ODNR. The superintendent will be the Contractor's representative at the site and shall have the authority to act on behalf of the Contractor. All communications given to the superintendent shall be as binding as if given to the Contractor.

PART 20 - SAFETY AND PROTECTION

The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The Contractor shall take all

necessary safety precautions and shall provide the necessary protection to prevent and mitigate damage, injury or loss resulting from his construction activities to:

a) All employees on the work site and all other persons who may be affected thereby;

b) All the work, and all materials and equipment to be incorporated therein, whether installed, in storage on or off the site under the care, custody or control of the Contractor; and

c) Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall give all notices and comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the safety of persons or property of their protection from damage, injury or loss.

The Contractor shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

No Contractor shall cut away timber, dig foundations, or begin demolition without the full knowledge and consent of ODNR, and shall be held responsible for any damage resulting from any violations of the provisions of this clause.

When the use or storage of hazardous materials or equipment is necessary for the execution of the work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.

PART 21 - MISCELLANEOUS CONSTRUCTION COSTS

The Contractor shall, at his own cost and expense, and in strict conformity with the Contract Documents, furnish all the materials, labor, utilities, transportation, and superintendency and all equipment, including, but not limited to sheeting, shoring, bracing, scaffolding, tools, derricks, tackle, implements, machinery and appliances of every kind necessary or proper for the purpose, whether temporary or permanent and whether or not incorporated into the work.

PART 22 - APPLICABLE LAWS AND REGULATIONS

The Contract Documents will be governed by the laws, codes and regulations of the place of the project. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations applicable to the work.

If the Contractor finds that the Contract Documents are or may be in conflict with applicable laws, ordinances, rules or regulations, the Contractor shall give, prior to performing the work in question, ODNR prompt written notice, specifying each conflict.

In as much as the Contractor is required to be familiar with the code requirements applicable to his work, if the Contractor performs any work contrary to such laws, codes, rules and regulations, and fails to provide written notice to ODNR, the Contractor shall bear

sole liability for all consequences.

PART 23 - ROYALTIES AND PATENTS

The Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Contract or the incorporation in the Contract of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others.

If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Contract and if to the actual knowledge of ODNR its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by ODNR in the Contract Documents.

The Contractor shall indemnify and hold harmless ODNR and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorney's fees) arising out of any infringement of patents rights or copyrights incident to the use in the performance of the Contract or resulting from the incorporation in the Contract of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

PART 24 - CHANGES IN THE WORK

24.1 ODNR May Require Change Orders

ODNR may require the Contractor to perform changes in the work consisting of additions, deletions, or other revisions. The contract price and contract time may be adjusted accordingly. All such changes in the work must be authorized by a Change Order and shall be performed under the applicable conditions of the Contract Documents.

24.2 Unauthorized Work

Only work that has been authorized by a Field Order or a Change Order is eligible for compensation under this contract. Any work performed by the Contractor without an approved Field Order or Change Order shall be considered to have been performed within the scope of the Contract Documents at no cost to ODNR.

24.3 Determining Change Order Prices

The following methods shall be used to determine the price of change order items:

a) If the Change Order involves a twenty-five percent (25%) or less change in quantities for unit price items, the price for deductions or extra work involving these items must be at the unit price quoted by the Contractor on his original bid proposal.

b) If the Change Order involves a greater than twenty-five percent (25%) change in quantities for unit price items, the applicable unit prices may be equitably adjusted. Any such adjustments must, however, be made prior to the work being performed.

c) If the Change Order involves items not listed on the original bid schedule, the Contractor must present ODNR with labor and material price quotes for the proposed Change Order items. These quotes may be requested by ODNR either in terms of unit prices or as lump sums.

d) If the scope of the work involved in the Change Order is not readily definable, ODNR may request the work to be performed on a time and material basis with a not-to-exceed figure. This method shall be based on unit prices for both labor and materials which must be agreed to by ODNR prior to the Contractor initiating work on these items.

e) On direct subcontractor change order work, the Contractor is limited to a maximum of 10% mark-up to cover the costs of overhead, profit and bond.

24.4 Disputes Regarding Change Order Prices

If the Contractor and ODNR cannot agree on the cost of the work, the latest issue of the "Means Building Construction Cost Data" shall be used as a basis to determine and set a fair price for the work and materials at issue. Disagreement with this Change Order price determination authorizes the Contractor to invoke the dispute resolution procedures in accordance with Part 18 of Section 01000.

24.5 Contractor's Right to Request Change Orders

The Contractor may initiate a request for a Change Order anytime he determines such is appropriate

24.6 ODNR's Right to Direct Extra Work

ODNR may issue a Field Order directing a contractor to perform extra work immediately.

24.7 Monetary Compensation for Delays

No requests for additional monetary compensation due to delays by other contractors working at the site or by interruptions by utility companies will be entertained by ODNR. All such requests shall be referred to the entity responsible for the delay.

24.8 Preparation of Change Orders

ODNR shall issue all Change Orders. When the exact scope of work for the proposed change order can be delineated and all prices are agreed to between the Contractor and ODNR, the scope and price are both to be entered on the Change Order form. When signed by both parties, the Change Order gives the contractor immediate approval to proceed with the proposed work items.

PART 25 – PAY ESTIMATES

25.1 General Information

The Contractor shall normally submit Pay Estimates once a month. Payment shall not be considered acceptance of the work by ODNR.

25.2 What Documents to Submit

The pay estimate shall be submitted on the standard form furnished by ODNR. Each application for payment shall be accompanied by certifications by the Contractor that:

a. The quantities shown represent the actual value of accomplishment under the terms and conditions of the Contract Documents, including full compliance with all labor provisions;

b. All subcontractors and material suppliers have been paid. As certification, each application for payment shall be accompanied with properly executed "waiver of Liens" from all subcontractors and material suppliers to show that all previous payments made by ODNR have been applied to fulfill, in full, all of the Contractor's obligations reflected in prior application for payment;

c. The as-built drawings have been annotated to show all work performed through the date of the application for payment;

d. Payrolls are correct and applicable wage rates have been paid, if not previously submitted (See Section 00200);

e. Statewide Input Form 29 Employment Utilization Reports, covering the period for the full month of the previous estimate to the full month of the latest estimate (see Section 00300) are attached;

f. The Construction Progress Schedule and lists of material suppliers and subcontractors are up to date, or if not, up to date schedules and lists are submitted with the payment; and

g. An Affidavit of Contractor Payment Form for each EDGE-certified subcontractor and material supplier receiving payment from the previous month's approved pay request is attached.

To avoid rejection of the pay request due to errors or omissions and expedite processing, the Contractor is encouraged to review a draft (pencil) copy with ODNR prior to submitting the original signed pay estimate. The date shown on the pay request should be within a few days of the submittal date to avoid rejection of the pay estimate for failure to provide ODNR adequate time to completely process the request within thirty (30) days of the date of the estimate.

All pay estimates must be mailed or hand delivered to the ODNR Division of Engineering at 2045 Morse Road, Building E-3, Columbus, Ohio 43229-6693.

25.3 ODNR's Right to Decline, Reduce or Delay Payments

ODNR may, with prior notice to the Contractor, decline, reduce or delay the processing of payment requests or (because of subsequently discovered evidence or subsequent observations), may nullify, delay or reduce the whole or any part of any payment previously issued, to such extent as may be necessary in ODNR's opinion to protect ODNR from loss because of:

a. Defective or damaged work not being expediently remedied;

b. Third party claims filed or evidence indicating probable filing of such claims;

c. Failure of the Contractor to promptly pay subcontractors for labor or materials;

d. Evidence that the work cannot be completed for the unpaid balance of the Contract;

e. Damage to ODNR or another contractor;

f. Persistent failure to carry out the work in accordance with the Contract Documents;

g. Persistent failure to comply with orders of ODNR;

h. Evidence that liquidated damages will be assessed the Contractor;

i. Failure of the Contractor to submit and adhere to an approved construction progress schedule;

j. Failure of the Contractor or subcontractor(s) to comply with the requirements of Chapter 4115 of the Revised Code (Wages and Hours on Public Works);

k. Failure of the Contractor or subcontractor(s) to comply with the Equal Employment Opportunity in the Construction Industry laws in Chapter 123:2-3 through 123:2-9 of the Administrative Code; and/or

l. Failure of the Contractor to comply with the requirements of the EDGE business development program specified in Section 00500.

When the above grounds are removed, payment shall be made for amounts withheld because of them.

25.4 Payment for Delivered Materials

There shall be allowed by ODNR, and paid to the Contractor, a sum at the rate of ninety-two percent (92%) of the paid invoice costs (not to exceed 92% of the total material price bid in a unit price contract) of material delivered on the site of the work, or other approved storage site under the possession and control of the Contractor and in the vicinity of the work. Such stored materials shall be inspected by ODNR and must meet the requirements of the Contract Documents. Additionally, the following documentation must be provided by the Contractor: a certificate of insurance specifically covering said item(s) in their storage location, or a certified letter from the Contractor's general insurance carrier noting full coverage of these items in their storage location, and a letter from the Contractor's bonding company recognizing ODNR's intent to release 92% of the invoice value, even though the material is not on-site. The balance of such invoiced value shall be paid when such material is incorporated into and becomes a part of the project.

When an estimate amount is allowed on account of material delivered to the site of the work or other approved storage site and under the possession and control of the Contractor, but not yet incorporated into the project, such material shall become the property of ODNR. If such material is stolen, destroyed, damaged or becomes unacceptable to ODNR before being installed, the Contractor will be required to replace it at his own expense.

In order to request payment for materials stored at locations other than the project site, a copy of the vendor's invoice or statement showing the paid invoice cost of the materials and equipment for which payment is requested shall be submitted along with proof of bond coverage by the storage facility with each application for payment.

25.5 Payment for Allowances

Pay estimates which include request for partial or total payment of allowances shall include written documentation in the form of an invoice or letter verifying the actual amount being requested for payment.

25.6 Payments to Subcontractor and Suppliers

Upon receipt of payment from ODNR, the Contractor shall within ten (10) calendar days reimburse each subcontractor and material supplier for labor and materials for which the Contractor has received payment from the State. The Contractor shall require each subcontractor to make payments to his subcontractor in a similar manner.

25.7 Effect of Liens on Payment Requests

By submitting an application for payment, the Contractor warrants and guarantees that title to all work, materials and equipment covered by any applications for payment, whether incorporated in the project or not, will pass to ODNR at the time of payment, free and clear of all liens, claims, security interests and encumbrances. If at any time there should be evidence of any lien or claim which is chargeable to the Contractor, ODNR will cause all subsequent payments due the Contractor to be withheld for the purpose of securing such lien or claim. Should there prove to be any such claim after payments are made, the Contractor may be required to refund to ODNR, a sum of money equal to the sum of all monies that ODNR may be compelled to pay in discharging any lien or claim on the premises made obligatory by the Contractor's default.

25.8 Deduction and Holding of Retainage Amounts

To ensure satisfactory completion of the Contract, ODNR will retain eight percent (8%) of the amount requested for labor on each application for payment until the work is fifty percent (50%) complete. Such amounts retained shall be held in an escrow account. All labor performed after the job is fifty percent (50%) complete shall be paid at the rate of one hundred percent (100%) of the amount requested for labor by the Contractor and approved by ODNR. No amounts will be retained by ODNR for amounts billed for materials on pay requests. A contract shall be considered to be fifty percent (50%) complete when the Contractor has been paid an amount equal to fifty percent (50%) of the total cost of the labor and fifty percent (50%) of the total cost of the material of the contract.

Upon commencement of the work, an escrow account shall be established in a financial institution chosen by ODNR and approved by the Contractor. The escrow agreement will provide that the financial institution will act as escrow agent, will pay interest on funds deposited in such account in accordance with the provisions of the escrow agreement and will disburse funds from the account upon the direction of ODNR. Compensation to the escrow agent for establishing and maintaining an escrow account shall be paid from interest accrued in the escrow account.

As each progress payment is made, the retainage with respect to that payment will be deposited by ODNR in the escrow account. The interest earned on funds in the account shall accrue for the benefit of the Contractor until the completion date named in the Contract

or the expiration of any authorized extension of such date. Interest earned after such date shall accrue for benefit of ODNR. Cost of compensation to the escrow paid out of interest earned shall be borne by the Contractor.

PART 26 - DAMAGES

26.1 Assessment of Liquidated Damages

It is understood and agreed that all work to be performed under the Contract shall be completed within the established contract completion date stipulated by the Contract Documents, unless an extension of time is granted by ODNR in accordance with the Contract Documents.

Upon failure to have all work completed by the contract completion date, or by an intermediate completion date specified in the Contract Documents, ODNR will be entitled to retain or recover from the Contractor, as liquidated damages and not as penalty, the amounts set forth in the following table for each and every calendar day thereafter until Contract completion. ODNR's right to recover liquidated damages shall be in addition to any other remedy allowed by law.

26.2 Schedule of Liquidated Damages

Original Contract Amount		**Amount of Liquidated Damages to be Deducted for Each Calendar Day of Overrun in Time**
For More Than	To And Including	
Up To $50,000.00		$150.00
$50,000.01	$150,000.00	$250.00
$150,000.01	$500,000.00	$500.00
$500,000.01	$2,000,000.00	$1,000.00
$2,000,000.01	$5,000,000.00	$2,000.00
$5,000,000.01	$10,000,000.00	$2,500.00
Over $10,000,000.00		$3,000.00

26.3 Payment of Liquidated Damages

Liquidated damages shall become immediately payable to ODNR upon submittal of any Pay Estimate from the Contractor submitted subsequent to the contract completion date, and will be applied to each partial pay estimate as a deduction to the amount paid the Contractor.

26.4 Delays by Other Contractors

In the event the Contractor feels that he has a just claim for monetary damages resulting from unnecessary delays caused solely by other contractors or subcontractors working at the site, the Contractor making the claim for damages shall be solely responsible for the

assessment and collection of any such damages from the contractor(s) at fault. Delays caused by other contractors or subcontractors shall not release the contractor from his liability for payment of liquidated damages. ODNR shall not be liable for any claim for damages caused by an alleged delay by any contractor or subcontractor.

26.5 Other Damages

ODNR shall not incur any liability for unabsorbed home office overhead, reduced cash flow, “lost time”, indirect damages, or any claims derived from the Eichleay Formula or similar formula, even if such damages are alleged based on breach of contract by ODNR.

PART 27 - CONTRACT TIME EXTENSIONS

If the Contractor is delayed in the completion of the work by causes beyond his control, he may request a Change Order for the extension of the Contract Completion Date within five (5) days from the beginning of such delay. All requests must include: 1) the cause of the delay; 2) justification that the delay has affected the critical path of construction; and 3) the number of days requested.

PART 28 - SUBSURFACE CONDITIONS

Requests by the Contractor for additional compensation related to subsurface conditions shall be submitted in accordance with Part 24 of Section 01000. All requests must include written justification as to why the subsurface condition that resulted in additional cost was not reasonably foreseeable.

PART 29 - OMISSIONS IN THE CONTRACT DOCUMENTS

If the Contractor perceives an error or omission in the Contract Documents, the Contractor shall immediately notify ODNR of such omission or error and shall not proceed with the work until directed by ODNR. Any work performed by the Contractor prior to clarification by ODNR may not be entitled to compensation.

PART 30 - ODNR'S RIGHT TO CONTROL WORK

30.1 Diligent Prosecution of the Work

Diligent prosecution of the work is the Contractor’s primary responsibility. ODNR may issue a Field Order to compel the Contractor to perform specific work as appropriate. A Field Order to perform work within the scope of the Contract shall not give rise to additional compensation.

30.2 ODNR’s Right to Suspend Work

ODNR may issue a Field Order requiring the Contractor to suspend or stop work. Such a Field Order may be based on weather, quality of materials or workmanship, sequence of work, or other factors.

30.3 ODNR’s Right to Perform Work

ODNR may furnish materials and labor and execute such work as ODNR may desire, in

addition to or in place of work authorized by the Contract. If ODNR performs work authorized by the Contract, ODNR may deduct the value of such work from the Contract.

PART 31 - TERMINATION OF THE CONTRACT

31.1 Suspension of the Work

If, in the judgement of ODNR, the Contractor is causing undue risk of damage to any part of the project or adjacent area, ODNR may suspend the work temporarily, either in whole or in part, for such period until, in the judgement of ODNR, the safe and proper prosecution of the work may be resumed. ODNR shall provide notice to the Contractor's surety of any suspension ordered pursuant to this section. Any failure of ODNR to suspend the work shall not relieve the Contractor of his responsibility to perform the work safely and in accordance with the Contract Documents.

The Contractor shall, upon receipt of a notice of suspension, cease work on the suspended activities and take all necessary or appropriate steps to limit disturbances and minimize costs with respect thereto. The Contractor shall furnish a report to ODNR within five (5) days of receipt of the notice of suspension, describing the status of the work, including without limitation results accomplished, conclusions resulting therefrom, and such other information as ODNR may require.

31.2 Termination for Convenience

ODNR may, at any time upon twenty (20) days written notice to the Contractor, terminate the Contract in whole or in part for ODNR's convenience and without cause. Upon receipt of a notice of termination for convenience, the Contractor shall immediately:

a. Cease operation as specified in the notice;

b. Place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete continued portions of the project;

c. Terminate all subcontracts and orders to the extent they relate to the work terminated;

d. Complete performance of any work not terminated; and

e. Take any actions that ODNR may direct for the prosecution and preservation of the terminated work.

Upon such termination, the Contractor shall be paid a fair and reasonable compensation in accordance with the Contract Documents for work completed, including any amount retained, and the value of materials ordered and delivered, less any salvage credit the Contractor may receive for them. The Contractor shall be entitled to a fair and reasonable profit for the work performed, but in no event shall the Contractor's compensation exceed the total Contract price. All materials, equipment, facilities, and supplies at the project site, or stored offsite, for which the Contractor has been compensated shall become the property of ODNR. Any dispute as to the sum payable to the Contractor shall be resolved in accordance with the provisions of the Contract Documents.

31.3 Termination for Cause

If ODNR determines that the Contractor has failed to prosecute the work with the necessary force, or has refused to remedy any defective work, ODNR shall notify the Contractor and the Contractor's surety of such failure or refusal. The Contractor shall begin to cure such failure or refusal within five (5) days of receipt of this notice.

If the Contractor fails to cure such failure or refusal within twenty (20) days of receipt of the notice, ODNR may terminate the Contract and employ upon the work the additional force or supply the materials or such part of either as is appropriate, and may remove defective work.

If the Contract is so terminated, the Contractor's surety shall have the option to perform the Contract. If the Contractor's surety does not commence performance of the work within ten (10) days of the date on which the Contract was terminated, ODNR may complete the work by such means as ODNR deems appropriate. ODNR may take possession of and use all materials, facilities, and equipment at the project site or stored offsite for which ODNR has paid.

If the Contract is so terminated, the Contractor shall not be entitled to any further payment. If ODNR completes the work and if the cost of completing the work exceeds the balance of the Contract price, including compensation for all direct and consequential damages incurred by ODNR as a result of the termination, such excess shall be paid by the Contractor or the Contractor's surety.

If the Contractor's surety performs the work, the provisions of the Contract Documents shall govern the surety's performance, with the surety being substituted for the Contractor in all provisions, including without limitation provisions for payment for the work and provisions concerning the right of ODNR to complete the work.

ODNR's right to recover liquidated damages shall not substitute for any right of recovery for additional costs incurred should the Contractor fail to complete the work.

31.4 Contractor Bankruptcy

If the Contractor files a voluntary petition in bankruptcy or if an involuntary petition in bankruptcy is filed against the Contractor, if the Contractor makes a general assignment for the benefit of creditors, or if a receiver is appointed for all or a substantial part of the Contractor's business or property, ODNR shall serve written notice on the Contractor and the Contractor's surety stating that any failure of the Contractor to provide adequate assurances of continued performance will be considered a rejection of the Contract and shall result in a termination of the Contract for cause. Such termination of the Contract need not be evidenced by an order of any court rejecting the Contract. Upon a final determination, either by a court or by arbitrators having jurisdiction, that such termination was improper, the termination will be deemed to be a termination for convenience. The Contractor's sole remedy for a wrongful declaration of default by ODNR shall be limited to recovery of profit on work completed prior to such declaration.

PART 32 - UTILIZATION OF FACILITIES BY ODNR PRIOR TO SUBSTANTIAL COMPLETION

32.1 Assessment of Responsibilities

Upon the request of ODNR to occupy or use any portion(s) of the work prior to Substantial Completion, the Contractor shall submit to ODNR, in writing, an Assessment of

Responsibilities regarding the insurance, security, operation, safety, maintenance, guarantee/warranty periods, heat, and utilities of the portion(s) of the work to be occupied or utilized by ODNR. Following the approval of the Assessment of Responsibilities by both parties, ODNR may then proceed to use or occupy said portion(s) of the work.

32.2 Effect on Retainage

ODNR will not partially release retainage, and the use or occupancy of portion(s) of the work prior to substantial completion shall not effect the release of retainage amounts to the Contractor. In order to have the retainage amount released, the Contractor MUST be able to meet the requirements for Contract Close-Out (See Part 34 of Section 01000).

32.3 Contractor Access to the Work

The use or occupancy of portion(s) of the work prior to Substantial Completion shall not affect the Contract Completion Date. In the event ODNR obtains partial or total use of the facilities, ODNR shall allow the Contractor reasonable access for other valid causes on a case-by-case basis mutually agreed to between ODNR and the contractor.

PART 33 - SUBSTANTIAL COMPLETION

33.1 Definition

The work called for under this Contract may be considered to be SUBSTANTIALLY COMPLETE when:

a) In terms of the cost of work, at least 95% of the work is complete;

b) Equipment Start-up requirements of Part 17 of Section 01100 have been met;

c) The work is deemed suitable for occupancy by the Division of Engineering;

d) All contractually required documentation has been received and approved;

e) All requested warranties and guarantees are in place;

f) All required equipment inspections and certificates of approval have been successfully obtained; and

g) All material testing results have been received and approved by ODNR.

33.2 Submittal Requirements

The Contractor must submit a written request to ODNR to issue a Notice of Substantial Completion. This written request must include a list of the remaining work items, the reasons why each item is incomplete, and the dates when each item will be completed. It shall also include all required O&M manuals, Inspection Certificates and Occupancy Permits. The Contractor shall also submit an Assessment of Responsibilities as described in Part 32.1 of Section 01000.

33.3 Inspection Requirements

Upon receipt of a complete request, ODNR shall schedule an inspection of the work. Upon completion of the inspection, ODNR shall provide the Contractor with a punch list identifying those items found to be incomplete or unacceptable. Any such punch list issued shall, however, not be considered to be complete or all-inclusive of all remaining items of work to be completed by the contractor.

33.4 Correction of Punch List Items

Upon receipt of the punch list, the Contractor shall immediately make such correction and do such things as are necessary to fulfill all Contract requirements. When the Contractor believes that he has satisfactorily completed all items on the lists, he shall notify the ODNR Project Manager to review the completed work items.

PART 34 – CONTRACT CLOSE-OUT

34.1 Final Inspection

When all work has been completed, the Contractor shall request a final inspection by ODNR. ODNR shall schedule, conduct, and generate a final inspection punch list. After the Contractor has completed the final inspection punch list items to the satisfaction of ODNR, and delivered all maintenance and operation instructions, schedules, guarantees, bonds, test results, certifications of inspection, as-built drawings, records, occupancy permits and has submitted all other documents as required by the Contract Documents, he may make application for final payment.

34.2 Final Payment

Upon receipt of the final pay request, ODNR will forward all final contract affidavits required to be completed by the Contractor. These forms must be signed, notarized and returned to ODNR. All such affidavits must be received by ODNR before the final pay request will be processed. Upon receipt and execution of the above-required documents, ODNR will promptly process the final pay request.

34.3 Certificate of Completion and Release of Retainage

Upon completion and acceptance of the work, ODNR shall issue a Certificate of Completion indicating that the work has been accepted under the conditions of the Contract Documents. Retainage held in the escrow account, with accumulated interest, will be paid to the Contractor.

34.4 Guarantees and Warranties

The Contractor shall guarantee his workmanship and materials for a period of one year from the date of the notice of Substantial Completion or the date of the Certificate of Completion (if no notice of Substantial Completion exists), unless modified by an Assessment of Responsibilities in accordance with Part 32.1 of Section 01000. Should defect(s) develop within the guarantee period, the Contractor shall promptly remedy the defect(s) and all damages caused by the defects or caused by correcting defects.

If the Contractor does not correct the defect(s) to the satisfaction of ODNR, then ODNR may proceed in the manner prescribed in the event of abandonment or forfeiture of the work by

the Contractor. The payment of claims for material and labor and other expenses shall be a prerequisite to the termination of the guaranteed period and to the release of the sureties on the Contract Bonds.

All representations, warranties, and guarantees made in the Contracts Documents shall survive final payment and termination or completion of this Contract.

PART 35 – CONTRACTOR PERFORMANCE EVALUATION

35.1 Performance Evaluation

ODNR will evaluate the Contractor's performance under this contract, and may consider the performance and resulting evaluation in determining if the Contractor is both a responsive and responsible bidder in award of future contracts with ODNR. A sample copy of the standard evaluation form and criteria to be used for this purpose follows this section.

END OF SECTION

SAMPLE

CONTRACTOR PERFORMANCE EVALUATION PROCEDURES

The Contractor's performance may be evaluated by ODNR's Project Manager throughout the duration of the contract, but as a minimum performance shall be evaluated when payments to the Contractor reach approximately 50% of the total contract amount and at the completion of the work. The Contractor's performance shall be rated on the criteria specified on the evaluation form, using the scale shown thereon.

Contractors without a prior ODNR performance rating shall be assigned an initial rating of "Satisfactory" by the ODNR Project Manager. A more accurate rating determination may be made by ODNR, based upon the Contractor's performance for other randomly selected clients for whom the Contractor completed work within three (3) years of ODNR's receipt of the Contractor's bid proposal.

ODNR shall provide written explanations for any ratings below the "Satisfactory" level and shall discuss each evaluation with the Contractor within one week of completing an evaluation.

The Contractor may provide rebuttals and request re-consideration of any rating from the ODNR Chief Engineer. Such requests must be made within thirty (30) days of the Contractor receiving a performance rating.

Multiple evaluations shall be averaged into a single final performance rating at the completion of the work. Normally, equal weight shall be given to each rating. However, at the discretion of ODNR additional weight (not to exceed 25%) may be given to ratings for extraordinary performance during a particular evaluation period.

This performance evaluation will be used by ODNR to help evaluate the responsibleness of the Contractor for future bid proposals. Each rating shall remain in effect for three years from the date it was determined. The following criteria and evaluation factors shall be used to determine ratings:

Quality

The Contractor will be evaluated on quality-related factors of the project, such as: compliance with contract requirements; accuracy; workmanship; and technical excellence.

Timeliness

The Contractor will be evaluated on time-related factors of the project, such as: meeting milestones; reliability; responsiveness; timeliness of submittals; responsiveness to unforeseen conditions; deliverables completed on-time; adherence to contract schedules; and timeliness in closing out the contract.

Cost Control

The Contractor will be evaluated on cost-related factors of the project, such as: initiatives taken to reduce project costs or to keep them within budget; initiatives taken towards meeting or reducing the contract completion time; submission of reasonably-priced and well documented change proposals; and providing current, accurate, and complete billing information.

Business Relations & Operations

The Contractor will be evaluated on business relations and operations-related factors for the project, such as: the ability to provide effective management of sub-contractors; if designated the lead prime, the ability to effectively lead other primes; meeting contract requirements for EEO, Drug Free Certifications, licenses, permits, Prevailing Wage, and EDGE; cooperative and proactive behavior with other prime contractors, the ODNR contract administration staff or its Consultant's staff, the ODNR client division staff, and other parties directly affected by the work; and the Contractor's commitment to customer satisfaction in general.

SAMPLE

CONTRACTOR PERFORMANCE EVALUATION FORM

Project Name _____

ODNR Project Number_____

Contractor _____

Subcontractor(s) (list only those having >25% of total contract)

_____
_____
_____

Current Project Status

0 50% Construction Complete (based on approved pay requests).
0 100% Construction Complete.
0 Other (as deemed appropriate if unusual events occur during the life of the project; e.g. significant performance problems, changes in the scope of work, or changes in the Contractor's team). Explain/Describe _____
_____
_____

CRITERIA	**RATING**
Quality	_____
Timeliness	_____
Cost Control	_____
Business Relations & Operations	_____
TOTAL	_____

Utilize the following ratings to evaluate the contractor's performance:

1 - Unsatisfactory* Majority of evaluation factors not met; frequent problems with the work or coordination efforts causing significant unrecoverable delays or costs to ODNR or other prime contractors; substantial or frequent avoidable re-work required; frequently failed to meet agreed upon timeframes; frequently submitted extraordinary change order demands with unsubstantiated prices; took greater than 90-days to close out project.)

2 - Marginal* Several evaluation factors not met; occasional problems with the contractor's work or coordination efforts causing recoverable delays or costs to ODNR or other prime contractors; some re-work required but not enough to cause significant delays or additional costs; occasionally failed to meet agreed upon timeframes; occasionally submitted change order demands with unsubstantiated prices; took 30 to 60 days to close out project.

3 – **Satisfactory** All evaluation factors completed acceptably or good faith effort was made to complete those that were not met; minor problems with the contractor's work or coordination efforts causing no significant delays or additional costs; rarely failed to meet agreed upon timeframes; routinely provided appropriate documentation for change order work; completed project close-out within 30-days.

4 - **Very Good** All evaluation factors met and several exceeded; minor problems with the contractor's work or coordination efforts developed but the contractor's corrective response was effective and expedient; project completed ahead of time and within budget.

5 – Exceptional All evaluation factors met and most exceeded; project completed ahead of time and within budget; exceptionally cooperative with other team members, noticeably helping them to successfully complete their work.

***Attach written documentation to substantiate ratings of "Unsatisfactory" or "Marginal". Document any known extenuating circumstances that significantly contributed to such ratings, including the performance of subcontractors, suppliers, or other prime contractors.**

Contractor responses provided and attached: Yes No

Date of Review _____

ODNR Project Manager (Printed Name) _____

ODNR Project Manager (Signature) _____

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SECTION 01100
GENERAL SPECIFICATIONS

PART 1 – FIELD DIMENSIONS AND ELEVATIONS

The Contractor shall provide a Registered Professional Surveyor, who, during the course of construction, shall establish all horizontal and vertical controls, including temporary benchmarks, necessary for the correct layout and construction of the work. Stakes for line and grade shall be placed in such a manner as to clearly define them for the project.

The finished work shall conform to the lines, grades, elevations and dimensions called for in the Contract Documents. The work shall be subject to review by ODNR. Acceptance of all or any part of it shall not relieve the Contractor of his responsibility to secure the proper dimensions, grades, elevations and locations of the several parts of the work.

The Contractor shall preserve all stakes, monuments and bench marks and shall have them reset when they are lost, displaced, damaged or removed. No additional compensation will be made for the cost to the Contractor of any of the work or delay occasioned by giving lines and grades, or making other necessary measurements, or by review of the work.

Wherever figures are given in this contract before or after the word "Elevation", or an abbreviation of it, or in a manner that indicates clearly that they are elevations, they shall mean the vertical distance above the datum elevation established for the project.

PART 2 - SITE CONDITIONS

2.1 Surface conditions

Where contours, topography, and profiles of the ground are shown on the Contract Documents, such contours, profiles and topography are believed to be reasonably accurate but are not guaranteed to be absolutely so, and are presented only as an approximation subject to verification by the Contractor prior to the work.

2.2 Subsurface Conditions

Reports of investigations and tests of subsurface and latent physical conditions at the site may have been relied upon by ODNR in preparation of the Contract Documents. Such reports are not guaranteed as to accuracy or completeness and are not part of the Contract Documents. Such information is shown solely for the convenience of the Contractor, who must verify the information to his own satisfaction.

PART 3 - SUBMITTALS

3.1 General Information

Within 45 days from the date of the Notice to Proceed, each contractor shall submit all required submittals, as noted in the Contract Documents The Contractor will not be eligible for a contract time extension due to his failure to submit the required submittals in a timely manner. As a courtesy, ODNR may provide each contractor a list of required submittals for reference. The completeness of this list, however, is not guaranteed and it shall be the responsibility of the Contractor to verify its completeness.
The Contractor shall, in writing, inform ODNR of all submittals that deviate from the requirements of the Contract Documents. Submittals that are part of a system shall be made as a fully integrated submittal that will enable ODNR to verify compliance with the Contract Documents.

3.2 Format Required for Submittals

The submittal(s) shall clearly identify the project name and number, and shall be complete with respect to dimensions, materials of construction, the name and address of the manufacturer and local supplier, and pertinent catalog numbers. The information shall include enough detail to permit ODNR to verify compliance with the Contract Documents and the design intent.

The Contractor shall submit enough copies of all submittals to allow ODNR to retain up to five (5) copies of each submittal.

3.3 Certifications Required

The Contractor's stamp of certification and signature shall be required on all copies of every submittal made to ODNR. The stamp of certification shall constitute a representation to ODNR that the Contractor has determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or assumes full responsibility for doing so, and that the Contractor has reviewed and coordinated each shop drawing and sample with the requirements of the Contract Documents.

3.4 Review of Submittals by ODNR

ODNR will review and act with reasonable promptness upon shop drawings and samples, but this review and action shall be only for conformance with the design concept of the project and for compliance with the information given in the Contract Documents, and shall not extend to means, methods, sequences, techniques or procedures of construction, or to safety precautions or programs incident to such factors. The review of and action upon a separate item will not indicate acceptance of the assembly in which the item functions.

The approval of the Contractor's submittals is for general conformance to the Contract Documents, but subject to the detailed requirements of the Contract Documents. Such review by ODNR shall not relieve the Contractor of his responsibility for the accuracy, proper fit, functioning or performance of any phase of the work included in the Contract Documents.

3.5 Resubmittal Procedures

If ODNR rejects a submittal as non-compliant with the Contract Documents, or if insufficient information has been provided to determine compliance, the Contractor shall make a resubmittal which complies with the Contract Documents or provides additional information

as required. Re-submittals shall be clearly identified by the Contractor as such, and all changes from the previous submittal shall be plainly evident through the use of conventional revision symbols, or an equally effective method.

3.6 Bound Set of Submittals to ODNR

Upon completion of the project, each prime Contractor shall turn over two bounds sets of all submittals, including shop drawings, cut sheets, manuals, warranties and guarantees, etc. to ODNR. This must be provided prior to submission of a final pay request.

PART 4 - TEMPORARY ACCESS

The location of all temporary roadways and similar facilities shall be subject to the approval of ODNR, and these shall be located and maintained so as not to interfere with other work performed by ODNR or by other contractors.

ODNR or other contractors may use temporary roadways or other facilities that a Contractor installs, maintains and removes at the completion of the work, at such reasonable time or times as may be directed by ODNR.

Upon completion of the work, the Contractor shall remove all temporary access and shall restore the areas disturbed in accordance with the Contract Documents

PART 5 - FIELD OFFICE

The General Trades Contractor shall provide and maintain an office on the site of the work during the construction period of the contract. This office shall be of substantial, weatherproof construction with windows and doors protected against entry of dust, dirt and rain, and shall be adequately lighted, heated and ventilated. The office shall also have a telephone, office furniture, a drafting table, and a minimum of one hundred (100) square feet of working space for the Consultant Project Representative and/or ODNR Project Manager.

The General Trades Contractor must maintain the following documents in the field office: a copy of the Contract Documents; a construction log book properly maintained by the Contractor; a set of record drawings; an updated progress schedule; a copy of all submittals; and all other permits or postings required by ODNR, the Ohio Revised Code, and Local/State/Federal regulatory agencies.

Other prime contractors shall provide their own field office for their own use.

PART 6 - MATERIAL AND EQUIPMENT DELIVERY

Shipments of material to be used by the Contractor in the work shall be scheduled for delivery to the site only during the regular working hours of the Contractor. If a delivery must be made during other than the normal working hours of the Contractor, his authorized agent shall be on duty to receive such material. No employee or agent of ODNR shall be authorized or requested to receive shipments designated for the Contractor.

PART 7 - STORAGE OF MATERIALS

All materials and equipment incorporated in the work shall be stored in clean, dry storage facilities acceptable to ODNR. Adequate storage facilities shall be maintained by the Contractor for the duration of the project. The Contractor shall bear sole responsibility for the security of all storage facilities, and shall provide ready access to ODNR as requested.

When the specifications for material or item of equipment requires, or manufacturer's product information recommends or mandates certain storage conditions or precautions, the facilities furnished by the Contractor shall incorporate means that will ensure compliance with such requirements.
All material and equipment damaged by action of water, temperature or the elements will be rejected as defective and shall be replaced by the Contractor at no cost to ODNR.

PART 8 - SANITARY FACILITIES FOR CONSTRUCTION PERSONNEL

Temporary sanitary facilities for the use of all persons employed on the work shall be supplied and maintained by the General Trades Contractor. The Contractor shall promptly and fully comply with all orders and regulations regarding sanitary facilities. At the completion of the work, the General Trades Contractor shall remove these temporary facilities to the satisfaction of ODNR.

PART 9 - TEMPORARY UTILITIES

9.1 Temporary Water Supply

The General Trades Contractor shall provide and pay for all water required for construction purposes on the project. The source, quality, and quantity of water furnished shall at all times be satisfactory to ODNR.

9.2 Temporary Electric Power

The General Trades Contractor shall make all the necessary arrangements for temporary light and power services and shall pay all charges, both for service installation and removal, if required, and for energy consumed until completion of the project.

9.3 Temporary Heat

The General Trades Contractor shall provide and pay for all temporary heat for all work areas of this Contract for such period of time and at such temperature as is necessary for the proper protection and execution of the work.

PART 10 - USE OF EXISTING ROADWAYS

Prior to the start of work, the General Trades Contractor must contact all agencies governing public roadways to be utilized for hauling of materials and shall provide the applicable agencies with whatever bonds, permits, etc., are required.

Prior to the start of work, each Contractor performing work within the right-of-way of existing roads shall be responsible for the payment of any bonds, etc., required by the agency having jurisdiction.

During the progress of the work, the Contractor shall provide access for both vehicular and foot traffic on any road, and shall indemnify and hold harmless ODNR from any expense due to the Contractor's operations. The Contractor shall also maintain free access to all fire hydrants, water and gas valves located along the line of his work. Gutters and waterways must be kept open or other provisions made for the removal of storm water.

The contractor shall be responsible for the cleaning of public roads utilized as access to the site to the satisfaction of the governing agencies having jurisdiction.

PART 11 – HOURS OF WORK

Normal hours of work are between 7:00 AM and 6:00 PM on Monday through Friday. Work at night, on weekends, or on legal holidays is not permitted without the prior written permission of ODNR. Should it be desired to perform regular and continuous night work, the lighting, safety and other facilities which are necessary for performing work at night must be provided by the Contractor at his own expense.

PART 12 - WORK IN INCLEMENT WEATHER

The Contractor is presumed to have taken all difficulties due to weather conditions into consideration in preparing his bid. He shall provide adequate protection of all work from unfavorable weather and extremes of temperature, to the satisfaction of ODNR.

Time extensions for abnormally inclement weather shall only be granted when the historical means of weather have been exceeded for that month and the critical path of work has been affected. Historical mean weather conditions shall be based on the historical mean information presented in the Climatological Summaries published by the U.S. Department of Commerce or other recognized local source of climatic data.

If the Contractor feels that the critical path of construction has been affected by abnormally inclement weather conditions, he may request a Contract time extension. This request must be made in writing within fifteen (15) days of the end of the affected period, and this request must include the following:

a. The type of adverse weather and specific dates affected;

b. The specific item(s) of work impacted and their relation to the critical path of construction;

c. A comparison with the historical mean weather conditions for the month in which the adverse weather occurred; and

d. The specific number of days requested for the Contract time extension.

PART 13 - USE OF EXPLOSIVES

The use of explosives shall not be permitted under any part of this project.

PART 14 - PROTECTION OF SURFACE FEATURES

The Contractor shall take all precautions necessary to protect private and public buildings, structures, fencing, lawns, trees, shrubs, roads, mailboxes, curbs, utilities and other surface features which may be adversely affected by construction activities. Damage shall be repaired by the Contractor, at his expense, including necessary regrading, repaving, seeding, sodding, replanting, and all other restoration required to achieve a result equal to, or better than the conditions prior to the commencement of work.

PART 15 - PROTECTION OF EXISTING UTILITIES

Prior to the commencement of work, the Contractor shall contact local gas, water, sewer, telephone, cable, electric and petroleum utilities to determine if they have underground facilities in the area of the project. As a part of this requirement, the Contractor shall also call the Utility Protection Service at 1-800-362-2764 a minimum of 48 hours prior to the start of any underground work.

If the utilities or underground structures are owned or operated by ODNR or another entity that does not provide a locating service, the Contractor shall be responsible for locating these utilities or structures.

The Contractor shall promptly repair all existing utility services interrupted or destroyed as a result of his actions.

PART 16 - TESTS AND INSPECTIONS

The Contractor shall give ODNR timely notice of the readiness of the work for all tests and inspections required by the Contract Documents. If any work to be tested or inspected is covered prior to testing or inspection, it shall be uncovered for observation and recovered at the Contractor's expense.

If a law, ordinance, rule, regulation, code or order of public body having jurisdiction requires specific work to be inspected, tested or approved, the Contractor shall have sole responsibility to ensure such inspection is performed by approved organizations and pay all costs for this inspection.

In the event that the results of a test observed by ODNR indicate that the materials, equipment, or workmanship failed to demonstrate adequacy or reasonable expectation of the necessary function of the work, the Contractor shall immediately undertake corrective action that is acceptable to ODNR. Upon completion of corrective action, the Contractor shall re-test in the presence of ODNR. This procedure shall be repeated as often as necessary until all facilities constructed under this Contract have successfully demonstrated their ability to perform the functions for which they were designed and installed.

PART 17 - EQUIPMENT START-UP

17.1 General Information

Equipment start-up shall not commence until the appropriate operation and maintenance

manuals have been accepted by ODNR. The Contractor shall supply all chemicals, lubricants, fuels and other consumable goods required for all start-up operations, and shall supply a 30-day allotment of all consumable goods required for the equipment.

Prior to the completion of the work and prior to either a notice of Substantial Completion or the final inspection, the Contractor shall make all necessary adjustments, calibrations and tests; balance and adjust all air and water flows; make appropriate settings of all valves; and perform all other necessary operations to render all equipment and systems fully operable as required.

The following steps, in the order presented, shall be completed for all equipment and systems furnished under this Contract, whether or not specifically stated under the individual detailed specification sections:

a. Individual system start-up conducted by the Contractor;

b. Individual system start-up conducted in the presence of ODNR;

c. Issuance of punch list(s) by ODNR for the individual systems;

d. Total system start-up under coordination of the Contractor;

e. Equipment operation training of ODNR personnel; and

f. Submittal of all approved equipment, system and building certificates of inspection to ODNR.

17.2 Individual System Start-up by Contractor

The Contractor's individual system start-up shall include whatever work is necessary to render each individual system operable as intended by ODNR, and shall include a rehearsal of the procedures that will be employed during the individual system start-up and testing witnessed by ODNR. Initial test runs, and necessary adjustments or repairs made as a result of such runs, shall be the sole responsibility of the Contractor.

17.3 Individual System Start-up in the Presence of ODNR

The Contractor shall notify ODNR one week in advance for each individual system that the Contractor believes is ready for start-up. The Contractor shall perform the following tests in the presence of ODNR: conduct dry runs of all equipment; check compatibility of equipment and controls with other equipment; conduct wet runs of equipment; and check all feed and flow rates. As a result of the start-up of an individual system, ODNR shall issue a punch list identifying all deficiencies found in the installation or operation of that system. The Contractor shall correct all deficiencies on these lists prior to total system start-up.

17.4 Total System Start-Up

Prior to the total system start-up, the Contractor shall ensure that all individual systems have been inspected and pre-tested as required by the Contract Documents. After such verification, the Contractor shall set the date and time for a start-up of the total system. ODNR shall be notified of this meeting in writing with no less than seven (7) days advance notice.

At the Total System Start-Up Meeting, ODNR and the Contractor, shall conduct a review of the total system. Deficiencies noted during this review shall be corrected by the Contractor prior to the issuance of any completion certificates.

17.5 Equipment Operation Training

The Contractor shall provide all required training to user personnel for the operation and maintenance of all equipment. After training is completed, the Contractor shall note the date(s) of the training and the names of the ODNR personnel trained, and shall include this information in the operations and maintenance manual(s) for the project.

PART 18 - CLEAN UP

As the work progresses and as may be directed by ODNR, each Contractor shall remove from the site and dispose of debris and waste material resulting from his work. The General Trades Contractor shall be responsible for the final cleaning of floors, walls, glass, and all surfaces of equipment and fixtures. The General Trades Contractor shall also clean the site of all rubbish except for packing material and material scraps, which shall be the responsibility of the Contractor whose material is involved.

PART 19 - RECORD DRAWINGS

Each Contractor shall keep an accurate record of all deviations from the Contract Documents. He shall neatly and correctly note any deviations on the drawings affected and shall keep this set of record drawings available for inspection at the site. One extra set of drawings will be furnished to the General Trades Contractor for this purpose. The Contractor shall protect this set of drawings from weather and damage, shall not roll this set of drawings, and shall tape all edges of each sheet.

As a minimum the record drawings shall show:

a. Distances between sewer service wyes and tees, with tie-in measurements to manholes and indication as to type of connection, length of house connection, and location depth of end of lateral;

b. Distances of underground utilities from prominent surface features (i.e., edges of pavements, trees, building edges, walkways, etc.);

c. Distances between water service connections, with tie-in measurements to valves, fire hydrants, laterals, and other fittings; and indications as to size of connection, length of service connection, location of curb or corporation stop and end of pipe;

d. Any existing utility services uncovered during the work; and

e. Every other feature or aspect of the completed project which was not shown on or deviates from the Contract Drawings, including work added or deleted through Change Orders.

At completion of the work and before final approval, the Contractor shall make any final corrections to the record drawings and submit them to ODNR.

PART 20 - OPERATION AND MAINTENANCE MANUALS

The Contractor shall compile manufacturer's operation and maintenance instructions for all equipment furnished by him under this Contract.

All instruction information shall be submitted as two complete sets, each set assembled into three-ring loose-leaf binders organized and indexed in the order of appearance in the detailed specifications. Information shall be divided into logical divisions, and each binder shall contain a table of contents specific to that binder. In all cases, information shall identify all precautions, procedures, adjustments, etc. that affect continuity of warranty coverage. The first sheet of each section shall list the following information appropriate for each item(s) for which all sheets immediately following apply:

a. Manufacturer's name, address, and telephone number;

b. Manufacturer's local distributor or representative's name, address, and telephone number;

c. The year of purchase and the year of manufacture of the equipment, where applicable;

d. Model and serial number(s). including a sub-listing for all assembly components (e.g. pumps, motors, variable speed devices, and other appurtenances);

e. A copy of the approved submittal for the item; and

f. A copy of the fully executed warranty certificate.

END OF SECTION

SECTION 01010
SUMMARY OF WORK

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Location
B. Scope of Work
C. General Contract

1.2 LOCATION

A. The project site address is as follows:
Caesar Creek State Park
8570 E SR 73
Waynesville, OH 45068

B. Access to the construction site is via the state park access road beyond the park office.

1.3 SCOPE OF WORK

A. Provide all labor, materials, equipment, tools, supplies, and services to install, equip, adjust, and put into satisfactory operation, all of the work specified and shown on the drawings to form complete and operational facilities. Perform the work and materials testing required by the Specification Sections, Drawings and Contract Documents, unless specifically noted otherwise. Any labor, material, equipment, or apparatus not specifically mentioned herein, or as shown on the drawings, which may be found to be necessary to complete or perfect any portion of the work in a substantial manner and in compliance with the requirements stated or implied by the specifications or drawings, shall be furnished by the contractor without additional compensation.

1.4 GENERAL CONTRACT

A. General

1. The following section includes informational descriptions for the basis of bid items listed on the bid schedule. Bidders to include all materials, labor and equipment costs for the bid items listed. Failure to list an item in the description below does not preclude it from the project or the bid amount. Bidder takes full responsibility for including all work in the bid per the contract documents.

2. Base Bid Work- The following summary of the Work is an overall summary of the salient features of the Work under the Base Bid. It does not supersede the requirements of other specific related Sections.

B. Allowance Items

1. Testing Lab: fees for Contractor’s testing agency and all required tests specified herein.
2. Floating Marina Services Building Buildout: Is an allowance for completion of the interior space and specific finishes as required to meet concessionaire’s requirements.

3. Electrical Work by Utility: allowance for work to be performed by the Utility, including connection to the existing service line and new transformer and meter at the main distribution panel. Pad for transformer is not included.

C. Lump Sum Bid Items

4. Mobilization/Demobilization: mobilization of equipment, trailers, site security and fencing, temporary power and utilities, and other associated costs except those covered under other bid items listed herein. Perform activities required by Section 01200 – Special Provisions.

5. Site Preparation: includes all work in Section 02111 except stripping and stockpiling topsoil. Includes clearing and grubbing, salvage of trees for habitat, tree protection fencing, pavement removals, pedestrian bridge removal, miscellaneous site demolition, and other activities associated with preparing the site for work.

6. Erosion Control: includes furnishing, installing, inspecting and maintaining all work in Section 02200 and as shown on plans, including silt fence, filter sock, stone tracking pad, erosion mat, and maintenance.

7. Site Earthwork- Upland: includes general excavation, placement of fill, compaction, and grading of the work depicted on the 1B drawings. Excludes stripping, salvaging or placement of topsoil (separate unit price items).

8. Site Earthwork - Basin: includes general excavation, placement of fill, compaction, grading, and excavation of lake bottoms in the dry. Excludes stripping, salvaging or placement of topsoil (separate unit price items).

9. Stream Realignment (ET1 and ET2): includes temporary diversion of the existing tributaries, final grading of stream beds, in-stream stone structures (J-hooks and cross vanes), placement of salvaged cobble.

10. Weir Control Structure: includes excavation for the structure, aggregate base, cast-in-place weir structure, timber stop-log and appurtenances.

11. Floating Marina Services Building: includes, furnishing and installation of the metal walls, framing, truss systems, blocking, siding, fascia, soffits, roofing, flashing, insulation, windows, plumbing, doors, hardware, flooring, gypsum board, ceiling, painting, lighting, plumbing, HVAC, and Miscellaneous Accessories

12. Fuel Attendant Building: includes furnishing and installation of a prefabricated steel building as shown on the plans in accordance with Section 13120-Prefabricated Metal Buildings. The building shall be anchored to dock framing in coordination with dock manufacturer. Electrical service location to be coordinated between building supplier and dock manufacturer.

13. Marina Fueling System: includes design, permitting, furnishing and installation of remote fuel fill, piping, transmission sumps, point of sale system, monitoring system, controls, alarms communications, electrical and communication wiring and connections to marina electrical panels, gangway connections, fuel dispensers, floating fuel barge, barge access, tank, tank accessories, piping, valves, and specialties for fuel distribution for gas dispensing on the new floating dockage as shown on the plans and in accordance with Section 15450-Fuel Distribution System, Section 13215 Fuel Storage Tank Floats and Section 13220 Aboveground Fuel Tank.

14. Sanitary Sewage Grinder Pump: includes the furnishing and installation of Grinder Pump/Lift Station, piping from unit to bulkhead connection, flexible connections on gangways, and electrical hookups in accordance with Plumbing Plans and Lift Station Specifications on drawing P-102.

15. Timber Bridge – Youth Pond: includes furnishing and installation of a Timber Bridge with reinforced concrete bridge abutments, excavation, backfill, compaction, structural steel support framing with bearing connections, wood support framing, wood decking, wood façade and wood/cable railing in accordance with Section 02890 – Wood Decking, Posts, Rails and Support Framing, Section 03300 – Cast-In-Place Concrete, Section 05116 – Structural Steel, Section 09900 – Paints and Coatings, Section 02220 – Site Earthwork and Section 02700 – Aggregate Base Course.

16. Marina Sanitary Pump Out System: includes sanitary pump-out unit, discharge piping from unit to the marina building sewage grinder pump. The pump-out system includes remote pedestals, suction hoses, appurtenances, wiring, controls, product piping, and wiring in accordance with Section 15410-Sanitary Pump Out for Marina Dockage.

17. Signage - Dock Signage: includes furnishing and installation of dock signage as shown on the plans in accordance with Section 10440-Signage.

18. Dockage – Floating Attenuator: includes design, furnishing and installation, labor and equipment associated with designing, supplying and installing the floating attenuator system, per Section 02488.

19. Dock Anchorage – Attenuator: includes the design, furnishing and installation of anchorage for attenuator as shown on the plans in accordance with Section 02488-Floating Docks and Gangways.

20. Dock Anchorage – Marina Docks: includes the design, furnishing and installation of anchorage for Marina Docks as shown on the plan in accordance with Section 02488-Floating Docks and Gangways.

21. Main Landside Connection: includes (2) 80-foot long 8-foot wide gangways and associated hardware, transition plates, piles, platforms, railings, platform concrete pad and gangway bulkhead structure as shown on the plans.

22. Reconnection of Existing Connection to Patrol Boat: includes relocation and attachment of the Existing Patrol Boat House to the existing stiff-arm and gangway as shown on the drawings.

23. Electrical – Site and Dockage: Includes furnishing and installing all site and dockage electrical wiring, conduits, hangers, penetrations, flexible connections, panels, timers, disconnects, and appurtenances. Also furnish and install connections to power utility system, transformer pad, light fixtures (and poles), fixtures (and pole bases), lighting and connection to site signage, dock utility centers, and lighted fire cabinets in accordance with plans and Division 16 specifications. Make provisions for expandability of electrical system for future connection and growth of Marina.

24. Retaining Wall at Transformer Pad: includes furnishing and installation of boulder retaining wall as shown on the plans, geotextile, and engineered fill in accordance with Section 02220-Site Earthwork and Section 02700-Aggregate Base Course.

25. Pavement Markings: includes layout and installation of parking lines, ADA Spaces, stop bars, crosswalks, double yellow centerline, as shown and detailed on plans s described under Sections 02780.
26. Signage – Traffic/Road Regulatory: includes furnishing and installing traffic signs, supports, foundations, and all incidentals necessary to provide signage complete and ready for service.

27. Signage: Park Entry Sign: includes furnishing and installation of Park Entry Signage as shown on the plans with reinforced concrete foundation and core wall, aggregate base, stone veneer, precast cap with channel light, steel laser cut park logo in accordance with Section 10440-Signage, Section 0421- Stone Veneered Walls, Section 03300-Cast-In-Place Concrete, Section 02220-Site Earthwork and Section 16521-Exterior Lighting.

28. Signage: Marina Drop Off Sign: includes furnishing and installation of Marina Drop Off Sign and seat walls as shown on the plans with reinforced concrete foundation and core wall, aggregate base, stone veneer, precast cap with channel light, aggregate base, painted lettered precast signage panels in accordance with Section 0421-Stone Veneered Walls, Section 03300-Cast-In-Place Concrete, Section 02220-Site Earthwork, Section 09900-Paints and Coatings and Section 16521-Exterior Lighting.

29. Stream Culvert Crossing: includes furnishing and installation of Culvert Crossing as shown on the plans with concrete elliptical culvert pipe, stone veneered reinforced concrete retaining walls, drainage mat and piping, stone fill to spring line, pipe bedding, Steel Backed Timber Guardrail, and engineered fill in accordance with Section 02620-Storm Drainage Piping, Section 03300-Cast-In-Place Concrete, Section 0421-Stone Veneered Walls, Section 02220-Siite Earthwork and Section 02700-Aggregate Base Course.

30. 1-Year Maintenance – Upland and Wetland Seed Areas: includes supplying all labor and materials to maintain all Prairie, Biofiltration, Savannah, Emergent, and Wet Prairie Seed Mix areas as described under Sections 02925 and 02922.

31. 1-Year Maintenance – All Plant Materials: includes supplying all labor and materials to maintain all plant material as described under Sections 02920.

32. Temporary Irrigation System: includes furnishing, installing, operating, and maintaining for the duration of the landscape establishment period a complete temporary irrigation system providing coverage of entire landscape, including all hoses, sprinkler heads, pumps, fittings, connections, and other incidental items. Includes removal of system at completion of landscape establishment period.

D. Unit Price Bid Items

33. Strip and Stockpile Topsoil: includes all striping and stockpiling of topsoil as shown on the plans in accordance with Section 02220 Paragraphs 3.01 and 3.02.
34. Salvaged Topsoil Placed: includes placement of salvaged topsoil and grading to meet required grades as shown on the plans, and per Section 02911.
33. Topsoil Furnished and Placed: includes furnishing topsoil (not salvaged on site) and grading to meet required grades as shown on the plans, and per Section 02911.

34. Salvaged Topsoil Placed: includes placement of salvaged topsoil and grading to meet required grades as shown on the plans, and per Section 02911.

35. Topsoil Furnished and Placed: includes furnishing topsoil (not salvaged on site) and grading to meet required grades as shown on the plans, and per Section 02911.

36. 48” RCP Storm Pipe Extension: includes excavation, connection, shoring, pipe, bedding, placement.

37. 42” RCP Storm Pipe Extension: includes excavation, connection, shoring, pipe, bedding, placement.

38. Filter Fabric for Revetment: includes the filter fabric beneath the revetted shoreline segments as shown on the plans and per Section 02480. Unit price is per square yard of fabric placed.

39. Bedding Stone for Revetment: includes the bedding stone for the revetted shoreline segments, per Section 02480 and as shown on the plans. Unit price is per ton of bedding stone placed.

40. Riprap Stone Revetment: includes the riprap for the revetted shoreline segments, per Section 02480 and as shown on the plans. Unit price is per ton of riprap stone placed.

41. Stacked Stone Block: includes the stacked stone block along shoreline, per Section 02480 and as shown on the plans. Unit price is per ton of stone placed.

42. Salvaged Rubble Mound Fish Habitat: includes the rubble mound structures for fish habitat in the lake, created using salvaged cobbles, as shown on the plans. Unit price is per mound including materials, labor, and equipment for installation of the mounds as shown on the plans.

43. Habitat Log Placement: includes placing (not salvaging or processing) the habitat logs and trees with rootballs for fish habitat along the shoreline and in the stream, as shown on the plans. Unit price is per log placed.

44. Pavement and Subgrade Repair: includes all labor, equipment and material to repair pavement and subgrade using standard practices, to return any damaged area to existing conditions in areas marked by RPR in the field. Areas will be distributed throughout the site.

45. Asphalt Pavement – 4.5”: includes furnishing and installing asphalt pavement on prepared grade as shown on plans in accordance with Section 02710-Asphalt Concrete Pavement.

46. Crushed Aggregate Base Course: includes furnishing and installing crushed aggregate base course and roadway shoulder on prepared subgrade as shown on plans in accordance with Section 02700-Aggregate Base Course and Shoulders.

47. Compacted Fill: includes furnishing, installation and compaction of fill material in accordance with Section 02220-Site Earthwork.

48. Concrete Curb and Gutter: includes furnishing and installation of Standard Curb, Ribbon Curb, Reject Concrete Curb and Gutter, and curb cuts as shown and detailed on plans in accordance with Section 03310-Concrete Paving.

49. Concrete Landscape Curb: includes furnishing and installation of Concrete Landscape Curb as shown and detailed on plans in accordance with Section 03310-Concrete Paving.

50. Path – Gravel: Includes placing and compacting gravel path as shown on the plans per Section 02705; furnishing and installing crushed limestone base aggregate, crushed limestone top course, and stabilizer binder for gravel path; performing all excavating and backfilling; properly disposing of surplus material and restoring adjacent surfaces; and furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the work.

51. Path – Concrete (Sidewalk): includes furnishing and installing aggregate base course and concrete pavement on prepared subgrade as shown on plans in accordance with Section 03310-Concrete Paving.

52. Detectable Warning Fields: includes procuring and installing detectable warning fields in pedestrian ramps as shown and detailed on plans.

53. Concrete Wheel Stops: includes procuring and placing concrete wheel stops as shown and detailed on plans.

54. Dockage – Head Piers and Slips: includes labor and equipment associated with supplying and installing the floating dockage system, per Section 02488 including all materials (floating docks, decking, connections, floats, substructure of floating marina services building, and accessories). Does not include gangways or main landside connection and platforms.

55. Dock Lights – Solar: includes procuring and installing solar lights on docks as shown on plans.

56. Access Control Gates (Dockage): includes procuring and installing access control gates on docks, including appropriate hardware and controls as shown on the plans

57. Access Control Fencing (Dockage): includes procuring and installing access control gates on docks, including appropriate hardware and controls as shown on the plans.

58. Dock Ladders: includes labor and equipment associated with providing and installing the safety ladders on the floating dockage system, as shown on plans and described in Section 02488.

59. Fire Extinguisher Cabinet – Unlit: includes procuring and installing fire extinguisher cabinets, fire extinguishers, and life rings, as shown on plans and described in Section 02870

60. Fire Extinguisher Cabinet – Lit: includes procuring and installing fire extinguisher cabinets, fire extinguishers, and life rings, as shown on plans and described in the specifications 02870

61. Fire Protection Staging Areas: includes procuring and installing 4-ft x 10-ft fire protection staging areas, Fire Protection Staging Area Sign, Fire Protection Staging Area flag, and bull rail along water side of staging area as shown on the plans.

62. Single Slip Dock Utility Centers: includes procuring and installing DUCs serving single slips and associated wiring, as shown on the plans and within the specifications

63. Double Slip Dock Utility Centers: includes procuring and installing DUCs serving double slips and associated wiring, as shown on the plans and within the specifications.

64. Navigation Aid Lights: includes the furnishing and installation of Navigation Aid Lights as shown on the plans in accordance with Section 11850-Navigation Aids and includes all necessary coordination with Floating Fuel Pier and Floating Attenuator manufacturer for mounting requirements.

65. RCP – 12-inch: includes procurement, excavation, installation, bedding, backfill and connection to catch basins and endwalls as shown and detailed on plans.

66. Perforated-PVC – 6-inch: includes procurement, excavation, installation, bedding, backfill and connection to catch basins as shown and detailed on plans.

67. Curb Inlet w/Grate: includes procurement, excavation, installation, bedding, backfill and connection to pipes as shown and detailed on plans.

68. Catch Basin Structure w/Grate: includes procurement, excavation, installation, bedding, backfill and connection to pipes as shown and detailed on plans.

69. RCP – Apron Endwall w/Grate and Concrete Cutoff Wall: includes procurement, excavation, installation, bedding, backfill and connection to piping as shown and detailed on plans.

70. 6-inch Waterline: includes excavating, shoring, furnishing and installing bedding stone and pipe, tracer wire and backfilling for 6” C-900 water main as shown on plans and in accordance with Section 02668 Facility Water Distribution.

71. 4-inch Domestic Water Main: Includes excavating, shoring, furnishing and installing bedding stone and pipe and backfilling for 4” C-900 water main as shown on plans in accordance with Section 02668 Facility Water Distribution. (from meter pit to marina gangway abutment).

72. 2-inch Sanitary Force Main: includes excavating, shoring, furnishing and installing bedding stone and pipe and backfilling for 2” force main as shown on plans and in accordance with Section 02570 Facility Sanitary Sewers.

73. Sanitary Force Main Connection: to Existing sanitary manhole includes excavation, shoring, furnishing and installing core drilling existing manhole as shown on plans and per Warren County Water & Sewer coordination.

74. Fire Hydrant Assembly: includes excavating, shoring, furnishing and installing fire hydrant and backfilling as shown on plans and in accordance with Section 02668 Facility Water Distribution.

75. 6-inch Gate Valve and Fittings: includes excavation, shoring, furnishing and gate valve & fittings & box as shown on plans and in accordance with Section 02668 Facility Water Distribution.

76. Water Main Connection: includes excavation, shoring, furnishing and installing live tap and gate valve & fittings & box as shown on plans and in accordance with Section 02668 Facility Water Distribution.

77. Water Main – Vault: includes excavation, shoring, furnishing and installing aggregate base, precast concrete vault (8-ft dia. manhole), piping, meter and backflow device as shown on plans, in accordance with Section 02668 Facility Water Distribution, and Caesar Creek Park Standards.

78. Plumbing – CPVC Piping: includes procuring, installing and testing CPVC potable water piping on floating docks, from the gangway abutment to the end of each dock, to the marina services building, connection to dock utility centers and as shown on plans. Includes pipe hangers or supports, access plates to surface of docks, and all fittings for future connections.

79. Plumbing – DUC Connections – includes procuring, installing and testing flexible piping connections from the potable water piping on floating docks to the DUCs as shown on plans.

80. Plumbing – Flexible Connections at Gangways – includes procuring, installing and testing flexible piping connections at the gangway for the potable water piping and fire protection piping as shown on plans.

81. Fire Protection – Dry Line 4” Piping on Docks: includes procuring ,installing and testing 4” galvanized fire protection piping on floating docks, from the gangway abutment to the last dry standpipe on each dock as shown on plans. Includes pipe hangers or supports and all fittings for future connections.

82. Fire Protection – Dry Line 4” Piping on Land: includes procuring ,installing and testing 4” galvanized fire protection piping on land, from the gangway abutment to the dry standpipe connection as shown on plans. Includes testing (200 psi), excavating, shoring, furnishing and installing bedding stone and pipe, and backfilling for 4” C-900 fire main from the gangway abutment to the dry standpipe connection as shown on plans in accordance with Section 02668 Facility Water Distribution.

83. Fire Protection – Dry Hydrants: includes procuring and installing 4” galvanized fire protection dry hydrants on floating docks as shown on the plans.

84. Fire Protection – Dry Standpipe Connection and Bollards: includes procuring and installing fire protection dry standpipe connection and bollards as shown on the plans.
85. Seed Mix – Emergent: includes furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work. Maintenance is provided under a separate bid item.

86. Seed Mix – Savannah: includes furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work. Maintenance is provided under a separate bid item.

87. Seed Mix – Wet Prairie: includes furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work. Maintenance is provided under a separate bid item.

88. Seed Mix – Prairie: includes furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all

damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work. Maintenance is provided under a separate bid item.

89. Seed Mix – Turf Grass: includes furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, handling, storing, placing, and incorporating fertilizer into the work; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work and provide mowing and maintenance as outlined in Section 02920.

90. Seed Mix – ODOT: includes furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, handling, storing, placing, and incorporating fertilizer into the work; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work and provide mowing and maintenance as outlined in Section 02920.

91. Seed Mix – Biofiltration: includes furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work. Maintenance is provided under a separate bid item.

92. Soil – Biofiltration: includes all work, materials, mixing, required testing, and incidentals necessary to place engineered soil mix for biofiltration to meet required grades as shown on the plans and per Section 02911.

93. Stone – Biofiltration (Cobble Stone Mulch): includes furnishing, transporting, handling and storing cobble stone mulch and geotextile fabric; excavating, placing, and raking stone mulch to depths indicated on plans and per Section 02911; and disposal of all excess and waste materials.

94. Emergent Wetland Plugs: includes plant plugs in emergent wetland areas along shoreline and in the stream. Price includes all work associated with establishing final vegetation, including seeding and mulch, watering, and maintenance.

95. Thru 100. All Tree and Shrub Bid Items: includes furnishing, transporting, handling, potting, storing, pruning, placing and replacing plant materials; excavation of plant holes, salvaging of topsoil, mixing and backfilling; furnishing and applying all required fertilizer, mulch, water, herbicides and anti-desiccant spray; disposal of all excess and waste materials; care; and furnishing all labor, tools, equipment and incidentals necessary to complete the work. Maintenance is provided under a separate bid item.

101. Perennials & Grasses –#1 Cont.: includes furnishing, transporting, handling, potting, storing, placing and replacing plant materials; excavation of plant holes and backfilling; furnishing and applying all required fertilizer, mulch, water, herbicides and other incidental items; disposal of all excess and waste materials; care; and furnishing all labor, tools, equipment and incidentals necessary to complete the work. Maintenance is provided under a separate bid item.

102. Perennials & Grasses – Perennial 2” Dia. Round Tapered Plugs: includes furnishing, transporting, handling, potting, storing, placing and replacing plant materials; excavation of plant holes and backfilling; furnishing and applying all required water, herbicides, and other incidental items; disposal of all excess and waste materials; care; and furnishing all labor, tools, equipment and incidentals necessary to complete the work. Maintenance is provided under a separate bid item.

103. Restoration Grade Plant Material, 1-2’ to 2-3’ Ht Bare Root: includes furnishing, transporting, handling, storing, placing and replacing plant materials; excavation of plant holes and backfilling; furnishing and applying all required water, herbicides, and other incidental items; disposal of all excess and waste materials; care; and furnishing all labor, tools, equipment and incidentals necessary to complete the work. Maintenance is provided under a separate bid item.

104. Erosion Matting – Slope Matting: includes furnishing, installing, and maintaining as necessary all erosion control matting on slopes, per plans and specifications.

105. Erosion Matting – Channel Erosion Matting: includes furnishing, installing, and maintaining as necessary all erosion control matting in the channel, per plans and specifications.

106. Herbicide Application for Native Seed Preparation: includes furnishing, handling, and applying all herbicide necessary to fully kill existing vegetation within all areas designated for native seed that were not re-graded under the current contract. Includes mowing of dead vegetation following herbicide application to height indicated for native seed placement.

1.5 ALTERNATE BID ITEMS

A. General: Bidders shall provide Alternate Bid Prices which shall be evaluated by Owner. Bidders shall not include Alternate Bid Prices in the Base Bid Proposal. If the required quantities of the items listed are increased or decreased by Change Order, the unit prices set forth in the Supplemental Unit Prices shall apply to such increased or decreased quantities when required.

B. Wave Attenuator with Public Access: includes procuring and installing 100-foot long 6-foot wide gangway, installing gangway abutment on prepared subgrade, hardware and transition plate; piles, floating wave attenuator anchorage, 12-ft wide x 200-ft dual purpose floating dockage/wave attenuator with walking surface, and solar lighting on dock as shown on plans.

C. Form Liner for Architectural Concrete: includes furnishing and installing Form Liner on the Culvert Crossing in lieu of natural stone veneer as shown on the plans and described in Section 03121.

D. Concrete Panel Decking for Floating Dockage: includes furnishing and installing concrete decking panels; modified cleats and ladder attachments; access panels, and dock utility center attachment plates; composite decking shall be used for side skirts, fillets, fire protection staging areas, and areas beneath transformers on the floating docks as shown on plans and described in Section 02488.

E. Composite Decking for Floating Dockage: includes furnishing and installing composite decking and side skirts on the floating docks as shown on the plans and described in Section 02488

F. Contech Express Pedestrian Bridge (10’x30’): includes furnishing and installing a Contech Express Pedestrian Truss Bridge (10'x30'), vertical pickets, abutments, grading, and decking described in Section 05120

1.6 SUPPLEMENTAL UNIT PRICES

A. General: Bidders shall provide Supplementary Unit Prices which shall be used for authorized Change Orders. Bidders shall not include Supplemental Unit Prices in the Base Bid Proposal. If the required quantities of the items listed are increased or decreased by Change Order, the unit prices set forth in the Supplemental Unit Prices shall apply to such increased or decreased quantities when required.

B. Rock Excavation: defined per Section 02220 Site Earthwork, Paragraph 3.04. Price includes hauling off and properly disposing of excavated material.

C. Unsuitable Material Excavation and Replacement with Suitable Fill: Price includes hauling off and properly disposing of excavated material and filling with suitable materials.

D. Temporary Seed: includes furnishing, handling, and storing all seed needed to hold areas for future seed installation; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material; repair of all damaged areas; watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work.

END OF SECTION

SECTION 01150
MEASUREMENT AND PAYMENT

1.1 GENERAL

A. Each Contractor shall furnish all labor, materials, tools, equipment, appurtenances and all services including O&M manuals, training and start-up services necessary to perform all Work required, at the unit prices for the items listed herein and such unit prices shall represent full compensation for such work.

B. The items of 1.4 below refer to and are the same Pay Items listed in the Bid Schedule. They constitute all of the Pay Items in this Contract. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, layout surveys, job signs, sanitary requirements, testing, safety devices, approval and record drawings, water supplies, power, maintaining traffic, removal of waste, watchmen, bonds, insurance, project coordination and all other requirements of the Contract Documents. Compensation for all such services and materials shall be included in the prices stipulated for the lump sum and unit price Pay Items listed herein.

1.2 RELATED CONDITIONS SPECIFIED ELSEWHERE

A. Payments to Contractor: Comply with Section 01000 – General Conditions, Part 25.

B. Changes in Contract Price: Comply with Section 01000 – General Conditions, Part 24.

C. Division of Contract: Comply with Section 00400 – Execution of Contract, Part 7.

1.3 MEASUREMENT AND PAYMENT

A. All bidders shall completely read each individual pay item description, whether or not he submits a bid for that pay item and become familiar with their responsibility under each pay item.

B. All equipment items requiring deliverables such as O&M manuals, spare parts and lubricants shall be limited to 90% payment until all required deliverables are delivered.

1.4 PAY ITEM DESCRIPTION

A. Allowance Items

1. Testing Lab:
    a. Measurement: Lump Sum.
    b. Payment:
        i. Payment for Testing Lab allowance shall constitute full compensation for all fees associated with the contractor’s material

testing agency and all required tests specified herein, based on actual invoiced cost.

ii. This item is established as an if-authorized lump sum Allowance.

2. Floating Marina Services Building Build out:
   a. Measurement: Lump Sum
   b. Payment:
      i. Payment for Marina Services Building Build out is an allowance for completion of the interior space and specific finishes as required to meet concessionaire's requirements.
      ii. This item is established as an if-authorized lump sum Allowance and shall be reimbursed based on actual invoiced cost.

3. Electrical Work by Local Utility:
   a. Measurement: Lump Sum.
   b. Payment:
      i. Payment shall constitute full compensation for electrical work to be performed by the Utility including installation of new service, new transformer and meter at the main distribution panel. Pad for transformer is not included.
      ii. This item is established as an if-authorized lump sum Allowance and shall be reimbursed based on actual invoiced cost.

B. General Contract, Lump Sum Bid Items:

4. Mobilization/Demobilization:
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for mobilization and demobilization of the Contractor's labor, equipment, and material. The Contractor will receive 25% of the bid amount for mobilization and delivery/installation of temporary project signage, 50% for job moves as work progresses, and 25% of the bid amount for demobilization and removal of temporary project signage.
   c. Related sections:
      i. Section 01200 – Special Provisions

5. Site Preparation:
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for Contractor's labor, equipment, and material for site preparation work as shown on the plans and as described in Section 02111. Includes clearing and grubbing, salvage of trees for habitat, tree protection fencing, pavement removals, pedestrian bridge removal, miscellaneous site demolition, and other activities associated with preparing the site for work.

c. Related sections:
   i. Section 02111 – Site Preparation

6. Erosion Control:
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for furnishing, installing, inspecting and maintaining (until final stabilization of vegetation) all work in Section 02200 and as shown on plans, including silt fence, filter sock, stone tracking pad, and diversions as required.
   c. Related sections:
      i. Section 02200 – Soil Erosion and Sedimentation Control

7. Site Earthwork- Upland:
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for Section 02220 work: general excavation, placement of fill, compaction, and grading. Excludes stripping, salvaging or placement of topsoil (separate unit price items).
   c. Related sections:
      i. Section 02220 – Site Earthwork
8. Site Earthwork- Basin:
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for Section 02220 work: general excavation, placement of fill, compaction, grading, and excavation of lake bottoms in the dry. Excludes stripping, salvaging or placement of topsoil (separate unit price items).
   c. Related sections:
      i. Section 02220 – Site Earthwork
      ii.

9. Stream Realignments (ET1 and ET2):
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for the temporary diversion of the existing tributary as shown on the plans, final grading of stream bed, furnishing and installing the in-stream stone structures (J-hooks and cross vanes), and placement of salvaged cobble.
   c. Related sections:
      i. Section 02220 – Site Earthwork
      ii. Section 02480 – Stone Revetment

10. Weir Control Structure:
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for excavation for the weir control structure, and furnishing and installing the aggregate base,

cast-in-place weir structure, timber stop-log and appurtenances as shown on the drawings.

c. Related sections:
   i. Section 02220 – Site Earthwork
   ii. Section 02500 – Aggregate Base Course
   iii. Section 03301 – Cast-In-Place Concrete

11. Floating Marina Services Building:
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for furnishing and installation of the metal walls, framing, truss systems, blocking, siding, fascia, soffits, roofing, flashing, insulation, windows, plumbing, doors, hardware, flooring, gypsum board, ceiling, painting, lighting, plumbing, HVAC, Emergency Call Box, and Miscellaneous Accessories.
   c. Related Divisions and Sections:
      i. Section 02870 Site Furnishings
      ii. Division 04
      iii. Division 05
      iv. Division 06
      v. Division 07
      vi. Division 08
      vii. Division 09
      viii. Division 10
      ix. Division 15
      x. Division 16

12. Fuel Attendant Building:
   a. Measurement: Lump sum.
   b. Payment shall be full compensation for the furnishing and installing of the prefabricated steel building and electric as shown on the plans in accordance with Section 13120-Prefabricated Metal Buildings.

13. Marina Fueling System:
   a. Measurement Lump sum
   b. Payment shall be full compensation for designing, furnishing and installing of remote fuel fill, piping, transmission sumps, point of sale system, monitoring system, controls, alarms, communications, electrical and communication wiring and connections to marina electrical panels, gangway connections, fuel dispensers, floating fuel barge, barge access, tank, tank accessories, piping, valves, and specialties for fuel distribution for gas dispensing on the new floating dockage as shown on the plans.
   c. Related Sections:
      i. Section 02488-Floating Docks Marinas, and Gangways
      ii. Section 13215- Fuel Storage Tank Floats
      iii. Section 13220-Aboveground Storage Tanks
      iv. Section 15450 Fuel Distribution System

14. Sanitary Sewage Grinder Pump:
    a. Measurement Lump sum
    b. Payment shall be full compensation for designing, furnishing and installing of Grinder Pump/Lift Station system, piping, from unit to bulkhead connection, flexible connections on gangways and electrical hookups in accordance with Plumbing Plans and Lift Station Specifications on drawing P-102.
    c. Related Sections:
        i. Section 02488-Floating Docks Marinas, and Gangways
        ii. Section 02570-Facility Sanitary Sewers
        iii. Section 15400- Plumbing for Marina Dockage

15. Timber Bridge – Youth Pond:
    a. Measurement Lump sum.
    b. Payment shall be full compensation for the furnishing and installing concrete bridge abutments, excavation, backfill, compaction, structural steel support framing with bearing connections, wood support framing, wood decking, wood façade and wood/cable railing.
    c. Related Sections:
        i. Section 02890 – Wood Decking, Posts, Rails and Support Framing
        ii. Section 03300 – Cast-In-Place Concrete
        iii. Section 05116 – Structural Steel
        iv. Section 09900 – Paints and Coatings
        v. Section 02220 – Site Earthwork
        vi. Section 02700 – Aggregate Base Course

16. Marina Sanitary Pump Out System:
    a. Measurement Lump sum
    b. Payment shall be full compensation for designing, furnishing and installing of Marina Sanitary Pump Out Unit, discharge piping from unit to the marina building sewage grinder pump, including remote pedestals, suction hoses, appurtenances, wiring, controls, product piping, and wiring
    c. Related Sections:
        i. Section 15410-Sanitary Pump Out for Marina Dockage.

17. Dock Signage:
    a. Measurement: Lump sum.
    b. Payment:
        i. Payment shall be full compensation for all labor, equipment, and material for furnishing and installing all signage for floating docks and gangways as shown on plans and as described in Section 10440.
    c. Related sections:
        i. Section 10440 – Signage

18. Dockage – Floating Attenuator:
    a. Measurement: Lump sum.

b. Payment:
   i. Payment shall be full compensation for designing, furnishing and installing the floating attenuator system, per Section 02488
c. Related sections:
   i. Section 02488

19. Dock Anchorage – Attenuator:
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for designing, furnishing and installing the attenuator anchorage system, per Section 02488
   c. Related sections:
      i. Section 02488

20. Dock Anchorage – Marina Docks:
   a. Measurement: Lump sum.
   b. Payment:
      i. Payment shall be full compensation for designing, furnishing and installing the dock anchorage system, per Section 02488
   c. Related sections:
      i. Section 02488

21. Main Landside Connection:
   a. Measurement:
      i. Lump sum
   b. Payment:
      i. Payment shall be full compensation for designing, furnishing and installing the main landside connection to the floating docks: includes (2) 80-foot long 8-foot wide gangways and associated hardware, transition plates, piles, platforms, railings, platform concrete pad, excavation, compaction, crushed aggregate base course, and gangway bulkhead structure as shown on the plans and Section 02488.
   c. Related Sections:
      i. Section 02220-Site Earthwork
      ii. Section 02488 – Floating Docks Marinas, and Gangways
      iii. Section 02700-Aggregate Base Course
      iv. Section 03300 – Cast-In-Place Concrete
      v. Section 05115 – Steel Pipe Piles Marine
      vi. Section 09900 – Paints and Coatings

22. Reconnection of Existing Connection to Patrol Boat:
   a. Measurement: Lump sum
   b. Payment:

i. Payment shall be full compensation for relocation and re-attachment of the Existing Patrol Boat House to the existing stiff-arm and gangway as shown on the drawings.

23. Electrical – Site and Dockage:
    a. Measurement: Lump sum
    b. Payment:
        i. Payment shall be full compensation for furnishing and installing all site and dockage electrical wiring, conduits, hangers, penetrations, flexible connections, panels, timers, disconnects, and appurtenances. Also furnish and install connections to power utility system, transformer pad, light fixtures (and poles), fixtures (and pole bases), lighting and connection to site signage, dock utility centers, and lighted fire cabinets in accordance with plans and Division 16 specifications. Make provisions for expandability of electrical system for future connection and growth of Marina.
    c. Related Division:
        i. Division 16
    d. Related Sections:
        i. Section 02488 – Floating Docks Marinas, and Gangways
        ii. Section 15094 – Hangers Supports and Escutcheons

24. Retaining Wall at Transformer Pad:
    a. Measurement: Lump sum.
    b. Payment:
        i. Payment shall be full compensation for furnishing, installation, excavation, compaction, engineered backfill, geotextile, and boulders, per Section 02220.
    c. Related sections:
        i. Section 02220-Site Earthwork
        ii. Section 02700-Aggregate Base Course

25. Pavement Markings:
    a. Measurement: Lump Sum
    b. Payment:
        i. Payment shall be full compensation for all labor, equipment, and material for furnishing and installing all pavement marking as shown on plans and as described in Section 02780 Pavement Markings
    c. Related Sections:
        i. Section 02780 Pavement Markings
        ii. Section 02710 Asphalt Paving

26. Signage – Traffic/Road Regulatory: Measurement: Lump Sum
    a. Payment:
        i. Payment shall be full compensation for all labor, equipment, and material for furnishing and installing all traffic/road regulatory

signage as shown on plans and as described in Section 10440 Signage

b. Related Sections:
   i. Section 10440 Signage

Section 02710 Asphalt Paving

27. Signage: Park Entry Sign:
    a. Measurement Lump sum
    b. Payment shall be full compensation for furnishing and installing Park Entry Signage, reinforced concrete foundation and core wall, aggregate base, stone veneer, precast cap with channel light, steel laser cut park logo, and grading and backfill.
    c. Related Sections:
       i. Section 10440-Signage
       ii. Section 0421- Stone Veneered Walls
       iii. Section 03300-Cast-In-Place Concrete
       iv. Section 02220-Site Earthwork
       v. Section 16521-Exterior Lighting
       vi. Section 09900 – Paints and Coatings

28. Signage: Marina Drop Off Sign:
    a. Measurement Lump sum
    b. Payment shall be full compensation for furnishing and installing Marina Drop Off Sign and Seat Walls, reinforced concrete foundation and core wall, aggregate base, stone veneer, precast cap with channel light, painted lettered precast signage panels.
    c. Related Sections:
       i. Section 10440-Signage
       ii. Section 0421- Stone Veneered Walls
       iii. Section 03300-Cast-In-Place Concrete
       iv. Section 02220-Site Earthwork
       v. Section 16521-Exterior Lighting
       vi. Section 09900 – Paints and Coatings
29. Culvert Crossing:
    a. Measurement Lump sum:
    b. Payment shall be full compensation for furnishing and installing concrete elliptical culvert pile, stone veneered reinforced concrete retaining walls, drainage mat and piping, stone fill to spring line, pipe bedding, Steel Backed Timber Guardrail: and engineered fill.
    c. Related Sections:
       i. Section 02620-Storm Drainage Piping
       ii. Section 03300-Cast-In-Place Concrete
       iii. Section 0421-Stone Veneered Walls
       iv. Section 02220-Siite Earthwork
       v. Section 02700-Aggregate Base Course

30. 1-Year Maintenance – Upland and Wetland Seed Areas:
    a. Measurement: Lump sum.
    b. Payment:
        i. Payment shall be full compensation for maintenance of Upland and Wetland Seed Areas: includes supplying all labor and materials to maintain all Prairie, Biofiltration, Savannah, Emergent, and Wet Prairie Seed Mix areas as described under Sections 02925 and 02922.
    c. Related Sections:
        i. Section 02922 – Wetland Seeding
        ii. Section 02925 – Native Upland Seeding

31. 1-Year Maintenance – All Plant Materials:
    a. Measurement: Lump sum.
    b. Payment:
        i. Payment shall be full compensation for maintenance of all plant materials including supplying all labor and materials to maintain all plant material as described under Sections 02920 described under Sections 02925 and 02922.
    c. Related Sections:
        i. Section 02920 – Turf Seeding
32. Temporary Irrigation System:
    a. Measurement: Lump sum.
    b. Payment:
        i. Payment shall be full compensation for furnishing, installing, operating, and maintaining for the duration of the landscape establishment period a complete temporary irrigation system providing coverage of entire landscape, including all hoses, sprinkler heads, pumps, fittings, connections, and other incidental items. Includes removal of system at completion of landscape establishment period.
    c. Related Sections:
        i. Section 02920 – Turf Seeding
        ii. Section 02922 – Wetland Seeding
        iii. Section 02925 – Native Upland Seeding
        iv. Section 02930 – Planting

C. General Contract, Unit Price Bid Items:

33. Strip and Stockpile Topsoil:
    a. Measurement: Unit price (CY).
    b. Payment:
        i. Payment shall be full compensation for stripping and stockpiling topsoil per Section 02220 Paragraphs 3.01 and 3.02.
    c. Related sections:
        i. Section 02220 – Site Earthwork

34. Salvaged Topsoil Placed:
    a. Measurement: Unit price (CY).
    b. Payment:
        i. Payment shall be full compensation for placement of salvaged topsoil and grading to meet required grades as shown on the plans, and per Section 02911.
    c. Related sections:
        i. Section 02220 – Site Earthwork
        ii. Section 02911 – Soil Preparation

35. Topsoil Furnished and Placed:
    a. Measurement: Unit price (CY).
    b. Payment:
        i. Payment shall be full compensation for furnishing topsoil (not salvaged on site) and grading to meet required grades as shown on the plans, and per Section 02911.
    c. Related sections:
        i. Section 02220 – Site Earthwork
        ii. Section 02911 – Soil Preparation

36. 48" RCP Storm Pipe Extension:
    a. Measurement: Unit price (LF).
    b. Payment:
        i. Payment shall be full compensation for connecting, excavating, shoring, furnishing and installing bedding stone and pipe and backfilling for 48" RCP storm pipe extension as shown on plans. Unit price is per linear foot of pipe placed.
    c. Related sections:
        i. Section 02220 – Site Earthwork
        i. Section 02720 – Storm Drainage

37. 42" RCP Storm Pipe Extension:
    a. Measurement: Unit price (LF).
    b. Payment:
        i. Payment shall be full compensation for connecting, excavating, shoring, furnishing and installing bedding stone and pipe and backfilling for 42" RCP storm pipe extension as shown on plans. Unit price is per linear foot of pipe placed.
    c. Related sections:
        i. Section 02220 – Site Earthwork
        i. Section 02720 – Storm Drainage

38. Filter Fabric for Revetment:
    a. Measurement: Unit price (SY).
    b. Payment:
        i. Payment shall be full compensation for furnishing and installing the geotextile fabric beneath the revetted shoreline segments as shown on the plans and per Section 02480. Unit price is per square yard of fabric placed.

c. Related sections:
   i. Section 02480 – Stone Revetment

39. Bedding Stone for Revetment:
   a. Measurement: Unit price (TON).
   b. Payment:
      i. Payment shall be full compensation for furnishing and installing the bedding stone for the revetted shoreline segments, per Section 02480 and as shown on the plans. Unit price is per ton of bedding stone placed.
   c. Related sections:
      i. Section 02480 – Stone Revetment

40. Riprap Stone Revetment:
   a. Measurement: Unit price (TON).
   b. Payment:
      i. Payment shall be full compensation for furnishing and installing the riprap for the revetted shoreline segments, per Section 02480 and as shown on the plans. Unit price is per ton of riprap placed.
   c. Related sections:
      i. Section 02480 – Stone Revetment

41. Stacked Stone Block:
   a. Measurement: Unit price (TON).
   b. Payment:
      i. Payment shall be full compensation for furnishing and installing the stacked stone block along shoreline, per Section 02480 and as shown on the plans. Unit price is per ton of stacked stone placed.
   c. Related sections:
      i. Section 02480 – Stone Revetment

42. Salvaged Rubble Mound Fish Habitat:
   a. Measurement: Unit price (EA).
   b. Payment:
      i. Payment shall be full compensation for installing the rubble mound structures for fish habitat in the lake using salvaged cobbles, as shown on the plans. Unit price is for each mound placed.
   c. Related sections:
      i. None

43. Habitat Log Placement:
   a. Measurement: Unit price (EA).
   b. Payment:
      i. Payment shall be full compensation for installing (not salvaging or processing) the habitat logs and trees with rootballs for fish habitat along the shoreline and in the stream, as shown on the plans. Unit price is per log or tree unit placed.
   c. Related sections:
      i. Section 02111 – Site Preparation

44. Pavement and Subgrade Repair:

a. Measurement: Unit Price (SY).
b. Payment:
    i. Payment is full compensation for furnishing all materials, including replacement and restoration materials; cutting, removing, and disposing of existing pavement; shaping and compacting the exposed underlying material; placing new pavement; and restoring the shoulders and for all labor, equipment, and incidentals necessary to complete this work.
c. Related Sections:
    i. Section 02745 – Asphalt Pavement Repair
    ii. Section 02500 – Aggregate Base Course

45. Asphalt Pavement – 4.5”:
    d. Measurement: Unit price (CY).
    e. Payment:
        i. Payment shall be full compensation for furnishing and installing asphalt pavement on prepared grade as shown on plans in accordance with Section 02710-Asphalt Concrete Pavement. Unit price is per cubic yard of asphalt placed.
    f. Related sections:
        i. Section 02700 – Crushed Aggregate Base Course
        ii. Section 02710-Asphalt Concrete Pavement

46. Crushed Aggregate Base Course:
    a. Measurement: Unit price (TON).
    b. Payment:
        i. Payment shall be full compensation for furnishing and installing crushed aggregate base course and roadway shoulder on prepared subgrade as shown on plans in accordance with Section 02700-Aggregate Base Course and Shoulders . Unit price is per ton of stoned palced placed.
    c. Related sections:
        i. 02700-Aggregate Base Course and Shoulders

47. Compacted Fill:
    a. Measurement: Unit price (CY).(Measured in situ)
    b. Payment:
        i. Payment shall be full compensation for furnishing, hauling, installing, and compacting the fill material in accordance with Section 02220-Site Earthwork and as shown on the plans. Unit price is per cubic yard of fill material placed.
    c. Related sections:
        i. Section 02220-Site Earthwork

48. Concrete Curb and Gutter -Standard:
    a. Measurement: Unit price (LF).
    b. Payment:
        i. Payment shall be full compensation for furnishing and installing Standard Curb, Ribbon Curb, Reject Concrete Curb and Gutter, and curb cuts as shown and detailed on plans in accordance with

Section 03310-Concrete Paving and as shown on the plans. Unit price is linear feet of curbing placed.

c. Related sections:
   i. Section 03310-Concrete Paving

49. Concrete Landscape Gutter:
    a. Measurement: Unit price (LF).
    b. Payment:
       i. Payment shall be full compensation for furnishing and installing Concrete Landscape Curb as shown and detailed on plans in accordance with Section 03310-Concrete Paving and as shown on the plans. Unit price is linear feet of landscape curbing placed.
    c. Related sections:
       i. Section 03310-Concrete Paving

50. Path-Gravel:
    a. Measurement: Unit price (SF).
    b. Payment:
       i. Payment shall be full compensation for furnishing and installing crushed limestone base aggregate, crushed limestone top course, and stabilizer binder for gravel path; performing all excavating and backfilling; properly disposing of surplus material and restoring adjacent surfaces; and furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the work as shown on the plans. Unit price is square feet of Path-Gravel placed.
    c. Related sections:
       i. 02705 – Stabilized Crushed Limestone Surfacing
51. Path-Concrete (Sidewalk):
    a. Measurement: Unit price (SF).
    b. Payment:
       i. Payment shall be full compensation for furnishing and installing crushed aggregate base course, and concrete pavement on prepared subgrade; performing all excavating and backfilling; properly disposing of surplus material and restoring adjacent surfaces; and furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the work as shown on the plans. Unit price is square feet of Path-Concrete placed.
    c. Related sections:
       i. 03310-Concrete Paving

52. Detectable Warning Fields:
    a. Measurement: Unit price (EACH)
    b. Payment:
       i. Payment shall be full compensation for furnishing and installing detectable warning fields in pedestrian ramps as shown and detailed on the plans. Unit price is each for Detectable warning field installed.

53. Concrete Wheel Stops:
    a. Measurement: Unit price (EACH)
    b. Payment:
        i. Payment shall be full compensation for furnishing and installing concrete wheel stops as shown and detailed on the plans. Unit price is each for concrete wheel stop installed.
54. Dockage – Head Piers and Slips:
    a. Measurement: Unit price (SF).
    b. Payment:
        i. Payment shall be full compensation for labor and equipment associated with installing the floating dockage system, per Section 02488 including all materials (floating docks, decking, connections, floats, substructure of floating marina services building, and accessories). Unit price is per square foot of floating dockage installed, including the fuel pier (does not include gangways or main landside connection and platforms).
        ii. Related sections:
            1. Section 02488

55. Dock Lights – Solar:
    a. Measurement: Unit price (EA).
    b. Payment:
        i. Payment shall be full compensation for labor, materials and equipment for procuring and installing solar lights on floating docks as shown on the plans. Unit price is per light installed.
    c. Related Sections:
        i. Section 02488

56. Access Control Gates (Dockage):
    a. Measurement: Unit price (EA)
    b. Payment:
        i. Payment shall be full compensation for design, coordination, labor, materials and equipment for procuring and installing access control gates and associated automated security access on floating docks as shown on the plans. Includes main and accessory gates. Unit price is per access gate installed with access control.
    c. Related Sections:
        i. Section 02488 Floating Docks, marinas, and Gangways
        ii. Section 05116 Structural Steel
        iii. Section 09900 Paints and Coatings

57. Access Control Fencing (Dockage):
    a. Measurement: Unit price (LF)
    b. Payment:
        i. Payment shall be full compensation for design, coordination, labor, materials and equipment for procuring and installing access

control fences on floating docks as shown on the plans. Unit price is per linear foot of fence installed with access control.

c. Related Sections:
   i. Section 02488 Floating Docks, marinas, and Gangways
   ii. Section 05116 Structural Steel
   iii. Section 09900 Paints and Coatings

58. Dock Ladders:
   a. Measurement: Unit price (EA)
   b. Payment:
      i. Payment shall be full compensation for labor, materials and equipment for procuring and installing the safety ladders on the floating dockage system, as shown on plans and described in Section 02488. Unit price is per ladder.
      ii. Related sections:
         1. Section 02488

59. Fire Extinguisher Cabinets - Unlit:
   a. Measurement: Unit price (EA).
   b. Payment:
      i. Payment shall be full compensation for labor, materials and equipment for procuring and installing unlit fire extinguisher cabinets, fire extinguishers, and life rings, as shown on plans and described in Section 02870. Unit price is per fire extinguisher box installed with accessories.
   c. Related sections:
      i. Section 02870 – Site Furnishings

60. Fire Extinguisher Cabinets - Lit:
   a. Measurement: Unit price (EA).
   b. Payment:
      i. Payment shall be full compensation for labor, materials and equipment for procuring and installing lit fire extinguisher cabinets in similar style to dock utility centers, fire extinguishers, and life rings, as shown on plans and described in Section 02870. Unit price is per fire extinguisher box installed with accessories.
   c. Related sections:
      i. Section 02870 – Site Furnishings

61. Fire Protection Staging Areas:
   a. Measurement: Unit price (EACH)
   b. Payment:
      i. Payment shall be for full compensation for furnishing and installing 4-ft x 10-ft fire protection staging areas, Fire Protection Staging Area Sign, Fire Protection Staging Area flag, and bull rail along water side of staging area as shown on the plans. Unit price is each staging area and accessories installed.
   c. Related Sections:
      i. Section 02488 - Floating Docks Marinas, and Gangways

ii. Section 15400 – Plumbing for Marina Dockage

62. Single Slip Dock Utility Center:
    a. Measurement: Unit price (EA).
    b. Payment:
        i. Payment shall be full compensation for labor, materials and equipment for procuring and installing DUCs serving single slips and associated wiring, as shown on the plans. Unit price is per DUC.
    c. Related sections:
        i. Section 16600 – Dockside Utility Centers

63. Double Slip Dock Utility Center:
    a. Measurement: Unit price (EA).
    b. Payment:
        i. Payment shall be full compensation for labor, materials and equipment for procuring and installing DUCs serving double slips and associated wiring, as shown on the plans. Unit price is per DUC.
    c. Related sections:
        i. Section 16600 – Dockside Utility Centers

64. Navigation Aid Lights:
    a. Measurement: Unit price (EA).
    b. Payment:
        i. Payment shall be full compensation for labor, materials and equipment for procuring and installing navigation, as shown on plans and described in Section 11850. Unit price is per fire navigation light installed.
    c. Related sections:
        Section 11850 – Navigation Aids
65. RCP-12-inch:
    a. Measurement: Unit price (LF).
    b. Payment:
        i. Payment shall be for full compensation for furnishing and installing, bedding, backfill and connection to pipes as shown and detailed on plans. Unit price is linear feet of 12-inch concrete pipe placed.
    c. Related Sections:
        i. Section 02620 – Storm Drainage Piping

66. Perforated-PVC – 6-inch:
    a. Measurement: Unit price (LF).
    b. Payment:
        i. Payment shall be for full compensation for furnishing and installing, bedding, backfill and connection to pipes and structures as shown and detailed on plans. Unit price is linear feet of perforated 6-inch PVC pipe placed.

c. Related Sections:
   i. Section 02620 – Storm Drainage Piping

67. Curb Inlet w/ Grate:
    a. Measurement: Unit price (EACH)
    b. Payment:
       i. Payment shall be full compensation for furnishing and installing curb inlets with grates and connection to piping as shown and detailed on the plans. Unit price is each for Curb Inlet w/ Grate installed.
    c. Related Sections:
       i. Section 02620 – Storm Drainage Piping

68. Catch Basin Structure w/ Grate:
    a. Measurement: Unit price (EACH)
    b. Payment:
       i. Payment shall be full compensation for furnishing and installing catch basin structure with grates as shown and detailed on the plans. Unit price is each for Catch Basin Structure w/ Grate installed.
    c. Related Sections:
       i. Section 02620 – Storm Drainage Piping

69. RCP – Apron Endwall w/ Grate and Concrete Cutoff Wall:
    a. Measurement: Unit price (EACH)
    b. Payment:
       i. Payment shall be full compensation for furnishing and installing RCP – Apron Endwall w/ Grate and Concrete Cutoff Wall as shown and detailed on the plans. Unit price is each for RCP – Apron Endwall w/ Grate and Concrete Cutoff Wall installed.
    c. Related Sections:
       i. Section 02620 – Storm Drainage Piping
       ii. Section 03300 – Cast-In-Place Concrete

70. 6-inch Waterline:
    a. Measurement: Unit price (LF).
    b. Payment:
       i. Payment shall be for full compensation for furnishing and installing, excavating, shoring, furnishing and installing bedding stone and pipe, tracer wire, backfilling, and testing for 6” C-900 water main as shown on plans and in accordance with Section 02668 Facility Water Distribution. Unit price is linear feet of 6-inch waterline installed.
    c. Related Sections:
       i. 02668 Facility Water Distribution

71. 4-inch Domestic Waterline:
    a. Measurement: Unit price (LF).
    b. Payment:
       i. Payment shall be for full compensation for furnishing and installing, excavating, shoring, furnishing and installing bedding stone and pipe, tracer wire, backfilling, and testing for 4” C-900

water main as shown on plans and in accordance with Section 02668 Facility Water Distribution. Unit price is linear feet of 4-inch waterline installed. (from meter pit to marina gangway abutment)

c. Related Sections:
   i. 02668 Facility Water Distribution

72. 2-inch Sanitary Force Main:
    a. Measurement: Unit price (LF).
    b. Payment:
       i. Payment shall be for full compensation for furnishing and installing, excavating, shoring, furnishing and installing bedding stone and pipe, tracer wire, backfilling, and testing for 2” force water main as shown on plans and in accordance with Section 02570 Facility Sanitary Sewers. Unit price is linear feet of 2-inch sanitary sewer installed. (from meter pit to marina gangway abutment)
    c. Related Sections:
       i. 02570 Facility Sanitary Sewers

73. Sanitary Force Main Connection:
    a. Measurement: Unit price (EACH)
    b. Payment:
       i. Payment shall be for full compensation for furnishing and installing connection to existing sanitary manhole and includes excavation, shoring, furnishing and installing core drilling existing manhole as shown on plans and per Warren County Water & Sewer coordination. Unit price is each Sanitary Force Main Connection to existing manhole.
    c. Related Sections:
       i. 02570 Facility Sanitary Sewers

74. Fire Hydrant Assembly:
    a. Measurement: Unit price (EACH)
    b. Payment:
       i. Payment shall be for full compensation for furnishing and installing fire hydrant and includes excavation, shoring, furnishing and installing fittings and connections as shown on plans and per Warren County Water & Sewer coordination. Unit price is each Fire Hydrant Assembly.
    c. Related Sections:
       i. Section 02668 Facility Water Distribution

75. 6-inch Gate Valve and Fittings:
    a. Measurement: Unit price (EACH)
    b. Payment:
       i. Payment shall be for full compensation for furnishing and installing 6-inch Gate Valve, Box and Fittings and includes excavation, shoring, furnishing and installing fittings and connections as shown on plans and per Warren County Water & Sewer coordination. Unit price is each 6 -inch Gate Valve and Fittings.
    c. Related Sections:
       i. Section 02668 Facility Water Distribution

76. Water Main Connection:
    a. Measurement: Unit price (EACH)
    b. Payment:
        i. Payment shall be for full compensation for furnishing and installing live tap connection to existing water main and includes installing 6-inch Gate Valve live tap, Box and Fittings excavation, shoring, furnishing and installing core drilling existing manhole as shown on plans and per Warren County Water & Sewer coordination. Unit price is each Water Main Connection to existing main.
    c. Related Sections:
        i. Section 02668 Facility Water Distribution

77. Water Main - Vault:
    a. Measurement: Unit price (EACH)
    b. Payment:
        i. Payment shall be for full compensation for furnishing and installing aggregate base, precast concrete vault (8-ft dia. Manhole), piping, meter, backflow device, excavation, shoring, furnishing as shown on plans and Caesar Creek Park Standards. Unit price is each Vault.
    c. Related Sections:
        i. Section 02668 Facility Water Distribution

78. Plumbing – CPVC Piping:
    a. Measurement: Unit price (LF)
    b. Payment:
        i. Payment shall be full compensation for labor and equipment associated with installing and testing the CPVC potable water piping on floating docks, from the gangway abutment to the end of each dock to the marina services building, connection to dock utility centers and as shown on plans. Includes pipe hangers or supports, access plates to surface of docks, and all fittings for future connections. Unit price is per linear foot.
    c. Related sections:
        i. Section 15400 – Plumbing for Marina Dockage
        ii. Section 15094 – Hangers, Supports and Escutcheons

79. Plumbing – DUC Connections:
    a. Measurement: Unit price (EA).
    b. Payment:
        i. Payment shall be full compensation for labor, materials and equipment for procuring, installing and testing flexible piping

connections from the potable water piping on floating docks to the DUCs as shown on plans. Unit price is per connection to DUC.

c. Related sections:
   i. Section 15400 – Plumbing for Marina Dockage

80. Plumbing – Flexible Connections at Gangways:
    a. Measurement: Unit price (EA).
    b. Payment:
       i. Payment shall be full compensation for labor, materials and equipment for procuring, installing and testing flexible piping connections at the gangway for the potable water piping and fire protection piping as shown on plans. Unit price is per connection.
    c. Related sections:
       i. Section 15400 – Plumbing for Marina Dockage
81. Fire Protection – 4” Fire Protection Piping on Docks:
    a. Measurement: Unit price (LF).
    b. Payment:
       i. Payment shall be full compensation for labor, materials and equipment for procuring and installing 4” galvanized fire protection piping on floating docks, from the gangway abutment to the last dry standpipe on each dock as shown on plans. Includes pipe hangers or supports. Unit price is per linear foot.
    c. Related sections:
       i. Section 15400 – Plumbing for Marina Dockage
       ii. Section 15094 – Hangers, Supports and Escutcheons

82. Fire Protection – 4” Fire Protection Piping on Land:
    a. Measurement: Unit price (LF).
    b. Payment:
       i. Payment shall be full compensation for labor, materials and equipment for procuring and installing and testing 4” fire protection piping on land, from the gangway abutment to the dry standpipe connection as shown on plans. Includes testing (200 psi), excavating, shoring, furnishing and installing bedding stone and pipe, and backfilling for 4” C-900 fire main from the gangway abutment to the dry standpipe connection as shown on plans. Includes pipe fittings. Unit price is per linear foot.
    c. Related sections:
       i. Section 15400 – Plumbing for Marina Dockage
       ii. Section 02668 – Facility Water Distribution

83. Fire Protection – Dry Hydrants:
    a. Measurement: Unit price (EA).
    b. Payment:
       i. Payment shall be full compensation for labor, materials and equipment for procuring and installing 4” galvanized fire protection

dry hydrants on floating docks as shown on the plans. Unit price is per hydrant.

c. Related sections:
   i. Section 15400 – Plumbing for Marina Dockage
   ii. Section 15094 – Hangers, Supports and Escutcheons

84. Fire Protection – Dry Standpipe Connection and Bollards:
   a. Measurement: Unit price (EA).
   b. Payment:
      i. Payment shall be full compensation for labor, materials and equipment for procuring and installing fire protection dry standpipe connection and bollards as shown on the plans. Unit price is per hydrant.
   c. Related sections:
      i. Section 15400 – Plumbing for Marina Dockage

85. Seed Mix - Emergent:
   a. Measurement: Unit price (AC).
   b. Payment:
      i. Payment shall be full compensation for furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work per Section 02922, and as shown on the plans. Unit price is per acre of seeding.
   c. Related sections:
      i. Section 02922 – Wetland Seeding
86. Seed Mix - Savannah:
   a. Measurement: Unit price (AC).
   b. Payment:
      i. Payment shall be full compensation for furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work per Section 02925, and as shown on the plans. Unit price is per acre of seeding.
   c. Related sections:
      i. Section 02925 – Native Upland Seeding

87. Seed Mix - Wet Prairie:
   a. Measurement: Unit price (AC).
   b. Payment:
      i. Payment shall be full compensation for furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed;

furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work per Section 02922, and as shown on the plans. Unit price is per acre of seeding.

c. Related sections:
    i. Section 02922 – Wetland Seeding

88. Seed Mix - Prairie:
    a. Measurement: Unit price (AC).
    b. Payment:
        i. Payment shall be full compensation for furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work per Section 02925, and as shown on the plans. Unit price is per acre of seeding.
    c. Related sections:
        i. Section 02925 – Native Upland Seeding

89. Seed Mix – Turf Grass:
    a. Measurement: Unit price (AC).
    b. Payment:
        i. Payment shall be full compensation for furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, handling, storing, placing, and incorporating fertilizer into the work; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work and provide mowing and maintenance as outlined in Section 02920, and as shown on the plans. Unit price is per acre of seeding.
    c. Related sections:
        i. Section 02920 – Turf Seeding

90. Seed Mix – ODOT:
    a. Measurement: Unit price (AC).
    b. Payment:
        i. Payment shall be full compensation for furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, handling, storing, placing, and incorporating fertilizer into the work; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work and provide mowing and maintenance as

outlined in Section 02920, and as shown on the plans. Unit price is per acre of seeding.

c. Related sections:

i. Section 02920 – Turf Seeding

91. Seed Mix - Biofiltration:

a. Measurement: Unit price (AC).

b. Payment:

i. Payment shall be full compensation for furnishing, handling, and storing all seed; preparing the seed bed and sowing the seed; furnishing, hauling, placing, spreading, and anchoring of mulch material unless area is designated to receive erosion mat; repair of all damaged areas; initial watering; and furnishing all labor, tools, equipment, and incidental items necessary to complete the work per Section 02925, and as shown on the plans. Unit price is per acre of seeding.

c. Related sections:

i. Section 02925 – Native Upland Seeding

92. Soil-Bio Filtration:

a. Measurement: Unit price (CY)(in place).

b. Payment:

i. Payment shall be full compensation for furnishing, handling, materials, mixing, required testing, and incidentals necessary to place engineered soil mix for bio filtration to meet required grades as shown on the plans and per Section 02911. Unit price is per Cubic Yard of Bio Filtration Soil measured in place.

c. Related Sections

i. Section 02911 – Soil Preparation

93. Stone – Bio Filtration (Cobble Stone Mulch):

a. Measurement: Unit price (SF)

b. Payment:

i. Payment shall be full compensation for furnishing all materials including transporting, handling and storing cobble stone mulch and geotextile fabric; excavating, placing, and raking stone mulch to depths indicated on plans and per Section 02911; and disposal of all excess and waste materials. Unit price is per square foot of Stone – Bio Filtration (Cobble Stone Mulch) measured in place.

c. Related Sections:

i. Section 02911 – Soil Preparation

94. Emergent Wetland Plugs:

a. Measurement: Unit price (EA).

b. Payment:

i. Payment shall be full compensation for furnishing and installing plant plug in emergent wetland areas along shoreline and in the stream, as shown on the plans and per Section 02930. Unit price is per plug installed. Price includes all work associated with establishing final vegetation, including mulch, watering, and maintenance. Unit price is per each plant plug installed.

c. Related sections:
   i. Section 02930 – Planting

95. Thru 100. Deciduous Trees and Shrubs:
   a. Measurement Unit price (EA)
   b. Payment:
      i. Payment shall be full compensation for furnishing, transporting, handling, potting, storing, pruning, placing and replacing plant materials; excavation of plant holes, salvaging of topsoil, mixing and backfilling; furnishing and applying all required fertilizer, mulch, water, herbicides and anti-desiccant spray; disposal of all excess and waste materials; care; and furnishing all labor, tools, equipment and incidentals necessary to complete the work, per Section 02930 and as shown on the plans. Unit price is per tree or shrub installed.
   c. Related sections:
      i. Section 02930 – Planting

101. Perennials and Grasses Perennial - 1# Container:
   a. Measurement Unit price (EA)
   b. Payment:
      i. Payment shall be full compensation for furnishing, transporting, handling, potting, storing, placing and replacing plant materials; excavation of plant holes and backfilling; furnishing and applying all required water, herbicides, and other incidental items; disposal of all excess and waste materials; care; and furnishing all labor, tools, equipment and incidentals necessary to complete the work per Section 02930 and as shown on the plans. Unit price is per plant installed.
   c. Related sections:
      i. Section 02930 – Planting

102. Perennials and Grasses Perennial 2” Dia. Round Tapered Plugs:
   a. Measurement Unit price (EA)
   b. Payment:
      i. Payment shall be full compensation for furnishing, transporting, handling, potting, storing, placing and replacing plant materials; excavation of plant holes and backfilling; furnishing and applying all required water, herbicides, and other incidental items; disposal of all excess and waste materials; care; and furnishing all labor, tools, equipment and incidentals necessary to complete the work per Section 02930 and as shown on the plans. Unit price is per plant installed.
   c. Related sections:
      i. Section 02930 – Planting

103. Restoration-Grade Plant Material, 1-2’ to 2-3’ Ht Bare Root:
   a. Measurement Unit price (EA)

b. Payment:
   i. Payment shall be full compensation for furnishing, transporting, handling, storing, placing and replacing plant materials; excavation of plant holes and backfilling; furnishing and applying all required water, herbicides, predator protection and other incidental items; disposal of all excess and waste materials; care; and furnishing all labor, tools, equipment and incidentals necessary to complete the work per Section 02930 and as shown on the plans. Unit price is per plant installed.
c. Related sections:
   i. Section 02930 – Planting

104. Erosion Matting – Slope Matting:
   a. Measurement Unit price (SY)
   b. Payment:
      i. Payment shall be full compensation for furnishing, installing, and maintaining as necessary all erosion control matting on slopes, per plans and specifications. Unit price is per square yard installed.
   c. Related sections:
      i. Section 02930 – Planting

105. Erosion Matting – Channel Erosion Matting:
   a. Measurement Unit price (SY)
   b. Payment:
      i. Payment shall be full compensation for furnishing, handling, and applying all herbicide necessary to fully kill existing vegetation within all areas designated for native seed that were not re-graded under the current contract. Includes mowing of dead vegetation following herbicide application to height indicated for native seed placement. Unit price is per acre.
   c. Related sections:
      i. Section 02930 – Planting

106. Herbicide Application for Native Seed Preparation
   a. Measurement: Unit price (AC).
   b. Payment:
      i. Payment shall be full compensation for furnishing, handling, and applying all herbicide necessary to fully kill existing vegetation within all areas designated for native seed that were not re-graded under the current contract. Includes mowing of dead vegetation following herbicide application to height indicated for native seed placement, and incidental items necessary to complete the work per Section 02925, and as shown on the plans. Unit price is per acre of herbicide application.
   c. Related sections:
      i. Section 02925 – Native Upland Seeding

D. Alternative Bid Items:

1. Wave Attenuator with Public Access:
    a. Measurement: Lump Sum.
    b. Payment:
        i. Payment (ADD or DEDUCT) shall be full compensation for procuring and installing 100-foot long 6-foot wide gangway, installing gangway abutment on prepared subgrade, hardware and transition plate, piles, floating wave attenuator anchorage, additional cost to upgrade the base bid attenuator to provide a 12-ft wide x 200-ft dual purpose floating dockage/wave attenuator with walking surface. If an alternative bid for dock surface is chosen by the Owner as an alternate bid, the unit price ADD/DEDUCT shall be applied to the dock surface, and only if applicable.
    c. Related sections:
        i. Section 02220
        ii. Section 02488
        iii. Section 09900

2. Form Liner for Architectural Concrete:
    a. Measurement: Lump Sum
    b. Payment:
        i. Payment (ADD or DEDUCT) includes furnishing and installing Form Liner on the Culvert Crossing in lieu of natural stone veneer as shown on the plans and described in Section 03121.
    c. Related sections:
        i. Section 03121 Form Liners for Architectural Concrete
        ii. Section 03300 Cast in Place Concrete
3. Concrete Panel Decking for Floating Dockage:
    a. Payment (ADD or DEDUCT) shall be full compensation for furnishing and installing concrete decking panels; modified cleats and ladder attachments; access panels, and dock utility center attachment plates. Composite decking shall be used for side skirts, fillets, fire protection staging areas, and areas beneath transformers on the floating docks as shown on plans and described in Section 02488.
    b. Related Sections:
        i. 02488
4. Composite Decking for Floating Dockage:
    a. Payment (ADD or DEDUCT) shall be full compensation for furnishing and installing concrete decking panels; modified cleats and ladder attachments; access panels, and dock utility center attachment plates. Composite decking shall be used for side skirts, fillets, fire protection staging areas, and areas beneath transformers on the floating docks as shown on plans and described in Section 02488.
    b. Related Sections:
        i. Section 02488

5. Contech Express Pedestrian Truss Bridge (10'x30')
    a. Payment (ADD or DEDUCT) shall be full compensation for furnishing and installing a Contech Express Pedestrian Truss Bridge (10'x30'), abutments, grading, and decking.
    b. Related Sections:
        i. Section 05120 – Contech Bridge

E. Supplemental Unit Price Bid Items:

1. Rock Excavation:
    a. Measurement: Unit price (CY).
    b. Payment:
        i. Payment shall be full compensation for excavation of rock encountered on the site, should it be required to meet grades shown on the plans and per Section 02220. Supplemental unit prices are not included in base bid proposal.
    c. Related sections:
        i. Section 02220 – Site Earthwork

2. Unsuitable Material Excavating and Replacement with Suitable Fill
    a. Measurement: Unit price (CY).
    b. Payment:
        i. Payment shall be full compensation for excavation, off-site removal and replacement with suitable fill.
    c. Related sections:
        i. Section 02220 – Site Earthwork

3. Temporary Seeding:
    a. Measurement: Unit price (AC).
    b. Payment:
        i. Payment shall be full compensation for temporary seeding and mulching per Section 02925 and as directed by RPR. Unit price is per acre of seeding. Price includes all work associated with establishing final vegetation, including seeding and mulch, watering, and maintenance.
    c. Related sections:
        i. Section 02925 – Upland Seeding

END OF SECTION

SECTION 01200
SPECIAL PROVISIONS

PART ONE - GENERAL

1.01 GENERAL

A. The following information shall supplement, amend, or delete requirements contained within the appropriate sections of the General Conditions and General Specifications for this project. When items within Section 01200 contradict information within the General Conditions or General Specifications, this Section shall take precedence.

1.02 CONSTRUCTION DOCUMENTS

A. The work shall conform to the drawings and specifications entitled “Caesar Creek State Park, The Marina at Caesar Creek, Phase 1-REBID.”

B. The parts and details not fully shown on the drawings shall be prosecuted by the Contractor with the best established practices and as directed by ODNR.

C. The Contractor will be furnished four (4) sets of plans and specifications without charge. Additional plans and specifications will be furnished upon written request at the cost of reproduction.

D. Contractor will be furnished with electronic CAD files for layout.

1.03 LIMITATIONS OF OPERATIONS

A. The Contractor shall limit his operations so as to cause as little disturbance as possible to areas outside the limits of work.

B. Prior to beginning of work, ODNR will meet with the Contractor to indicate areas adjacent to the construction limits where specific features (trees, shrubs, or other plant life) shall be protected from damage. Costs for protecting these features shall be the responsibility of the Contractor.

C. The Contractor shall contact the proper local authorities concerning load limits, road crossing on public streets, etc., and shall be responsible for any approvals, permits or bond required.

1.04 USE OF PREMISES

A. The Contractor may only use the staging areas as shown on the drawings. No other staging areas will be allowed.

B. The Contractor shall assume full responsibility for the protection and safekeeping of all products under this contract stored at the site.

C. The Contractor shall be responsible to furnish and maintain restroom facilities in accordance with Section 01100, Part 8. All costs including labor, equipment and materials

for restroom facilities that are required shall be paid by the Contractor.

D. The Contractor may use existing power supply at the park. A convenient power supply may not be located near the project site.

E. The Contractor shall contact ODNR prior to beginning work regarding any additional specific regulations concerning the use of premises.

1.05 CONSTRUCTION EMPLOYEE PARKING AREAS

A. Construction employees may park personal vehicles in the parking lot near the Young Angler's Pond during the low season (October through April) or in other parking areas as designated by ODNR prior to beginning work. No construction vehicles will be allowed to park in the designated parking lots.

1.06 CONTRACTOR'S FIELD OFFICE

A. A field office located at the site, as noted in Section 01100, Part 5 of the General Specifications, is required for this project.

1.07 REFERENCE TO ODOT SPECIFICATIONS

A. Reference to "ODOT Item", "ODOT Paragraph X.XX" or "ODOT Standard Drawings X.XX" refers to items and paragraphs in the "Construction and Material Specifications" (CMS) published by the Ohio Department of Transportation (ODOT), State of Ohio, 2013 Edition, or the latest referenced ODOT Standard Drawing published prior to the date indicated on the project construction drawings. Such reference shall govern the conduct of the work herein, and have the same force and effect as though transcribed into these Specifications or the Drawings. Reference to "Director", etc. in these references shall mean "Engineer". Reference to ODOT items and paragraphs are for materials and methods only; measurements, acceptances, payments and general contract provisions shall be as noted or as described in the ODNR contract documents for this project. A copy of the CMS and the applicable ODOT Standard Drawings shall be on the job site at all times during the work.

1.08 FIELD ORDERS

A. In accordance with the General Conditions, Section 01000, Part 17.3, the Consultant's Project Representative may issue a field order to the Contractor provided verbal approval is granted from ODNR.

1.09 CONSTRUCTION SCHEDULE

A. The Contractor shall prepare a bar chart construction schedule and submit to ODNR for approval prior to the pre-construction meeting. The schedule shall also include the dollar value for each work task identified.

1.10 PRODUCT HANDLING AND PROTECTION

A. All stockpiles shall be neat, compact, completely safe and barricaded with warning

lights if necessary.

B. Precautions shall be taken so that no trees, shrubs, flowers, sidewalks, driveways or other facilities will be damaged by the storage of materials. The Contractor shall be responsible for the restoration of all stockpile sites to their original condition.

C. Materials, tools and machinery shall not be piled or placed against trees, unless they shall be amply protected against injury there from. All materials, tools, machinery, etc., stored upon public thoroughfares must be provided with red lights at night time so as to warn the traffic of such obstruction.

D. Materials shall be stored so as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the construction site may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefore must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the property owner or lessee, and copies of such written permission shall be furnished by ODNR. All storage sites shall be restored to their original condition by the Contractor at his expense.

1.11 ENVIRONMENTAL PROTECTION

A. The Contractor's performance of this contract shall be conducted so as to eliminate all unnecessary noise, dust and odors. The Contractor shall be responsible to prevent or limit pollution of air and water resulting from his operations.

B. The Contractor shall perform work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems and to prevent dust attributable to his operations from entering the atmosphere.

C. Dust at the work site shall be controlled in accordance with ODOT Item 616 and as directed by ODNR.

1.12 OVERHEAD AND PROFIT MARK-UP

A. On direct subcontractor change order work, the Contractor is limited to a maximum of 10% to cover the costs of overhead, profit and bond.

1.13 SUBMITTALS

A. See Section 01100, Part 3, of the General Specifications for submittal guidelines.

B. Shop drawings, manufacturer’s information, or Certified Test Data required for, but not limited to, the following items:

1. Silt fence fabric and stakes (Section 02200)

2. Filter sock (Section 02200)
3. Erosion mat (Section 02200)
4. Field test reports for Site Earthwork (Section 02220)
5. Geotextile fabrics (Section 02220)
6. General site fill, granular fill, and bedding and backfill for utilities (Section 02220)
7. Filter fabric for below revetment (Section 02480)
8. Manufacturer's stone gradation for riprap, bedding stone (Section 02480)
9. Test data for riprap, stacked stone, in-stream stone and bedding stone (Section 02480)
10. Dock, attenuator, gangway, and anchoring systems(Section 02488)
11. Test data for aggregate base course (Section 02500)
12. Sanitary sewer pipe and materials(Section 02570)
13. Drainage piping (Section 02620)
14. RCP storm pipe and joint materials (Section 02620)
15. Precast concrete catch basin shop drawing (Section 02620)
16. Catch basin frame and cover (Section 02620)
17. Sub drainage panels and filter fabrics(Section 02625)
18. Vault Assemblies, piping, meters, backflow devices, hydrants, valves, fittings, fasteners(Section 02688)
19. Product data for asphalt materials and aggregates (Section 02745)
20. Asphalt mix designs (Section 02745)
21. Qualification data for asphalt manufacturer (Section 02745)
22. Material certifications for asphalt manufacturer (Section 02745)
23. Material test reports for asphalt pavement (Section 02745)
24. Field quality-control reports for asphalt pavement (Section 02745)
25. Paint materials (Section 02780)
26. Fasteners product data (Section 02890)
27. Chemical Treatment manufacturers instructions (Section 02890)
28. Material Certificates (Section 02890)
29. Topsoil test reports (Section 02911)
30. Certificates of Compliance for turf seeding, fertilizer, seed, and herbicides (Section 02920)
31. Wetland seed mix submittals (Section 02922)
32. Upland seed mix submittals (Section 02922)
33. Plant material submittals (Section 02930)
34. Form Liner Product Data (Section 03121)
35. Stone Source and TRM (Section 03250)
36. Reinforcing steel shop drawings (Section 03300)
37. Concrete Mix Design (Section 03300)
38. Concrete Mix Design (Section 03310)
39. Steel Reinforcement (Section 03310)
40. Curing Compounds (Section 03310)
41. Concrete Aggregates (Section 03310)
42. Concrete test reports and material certificates (Section 03300 and Section 03310)
43. Joint sealant product data (Section 03315)
44. Cast Stone product data (Section 04720)
45. Steel Pipe Pile Shop Drawings, Mill Reports, Calculations, procedures, driving records (Section 05115)
46. Steel Shop Drawings, Mill Reports, Calculations, procedures, (Section 05115)
47. Shop Drawings (Section 05400)
48. Shop Drawings, detailed layout, calculations (Section 05425)

49. Shop Drawings, detailed layout, calculations (Section 05520)
50. Shop Drawings, detailed layout, calculations (Section 05700)
51. Underlayment and subflooring (Section 06100)
52. Product data and installation instructions (Section 07195)
53. Product data and installation instructions (Section 07461)
54. Product data, shop drawings, and installation instructions (Section 07610)
55. Product data, shop drawings, and installation instructions (Section 08111)
56. Product data, shop drawings (Section 08210)
57. Product data, shop drawings, and installation instructions (Section 08400)
58. Product data, shop drawings, and installation instructions (Section 08700)
59. Product data, shop drawings, and certification requirements (Section 09265)
60. Product data, shop drawings, and installation instructions (Section 09900)
61. Product data, shop drawings (Section 10426)
62. Product data, shop drawings, numbering scheme (Section 10440)
63. Product data, shop drawings, and installation instructions (Section 10522)
64. Product data, shop drawings, and installation instructions (Section 10800)
65. Product data, shop drawings, and installation instructions (Section 11850)
66. Product data, shop drawings, and installation instructions (Section 13120)
67. Product data, shop drawings, design calculations, and installation instructions (Section 13215)
68. Product data, shop drawings, design calculations, and installation instructions (Section 13220)
69. Product data, shop drawings, and installation instructions (Section 15094)
70. Product data, shop drawings (Section 15400)
71. Product data, shop drawings, Operations and Maintenance Manual (Section 15410)
72. Product data, shop drawings, design calculations, and installation instructions (Section 15450)
73. Product Data, field Quality Control Tests (Section 16060)
74. Product Data (Section 16075)
75. Product Data, field Quality Control Tests (Section 16120)
76. Product Data, field Quality Control Tests (Section 16124)
77. Product Data, Shop Drawings, Operation and Maintenance Data (Section 16140)
78. Product Data, Shop Drawings, Operation and Maintenance Data, field Quality Control Tests (Section 16211)
79. Product Data, Shop Drawings, Operation and Maintenance Data (Section 16271)
80. Product Data, Shop Drawings, field Quality Control Tests, Operation and Maintenance Data (Section 16341)
81. Product Data, Shop Drawings, field Quality Control Tests, Operation and Maintenance, Data Seismic Certification Data(Section 16430)
82. Product Data, Shop Drawings, field Quality Control Tests, Operation and Maintenance, Data Seismic Certification Data, Panelboard Schedules(Section 16442)
83. Product Data, Shop Drawings (Section 16521)
84. Product Data, Shop Drawings, Operation and Maintenance data (Section 16600)

C. Physical samples are required, at a minimum, for the following items:

1. Riprap stone (Section 02480)
2. Stacked stone (Section 02480)
3. Stone for in-stream structures (Section 02480)
4. Mulch material (Section 02930)
5. Aquatic planting staple (Section 02930)

6. Form Liners (Section 03121)
7. Cast Stone Masonry (04720)
8. Stone Veneered Walls (Section 04721)
9. Mineral fiber Cement Siding (07461)
10. Standing seam metal roof (Section 07610)
11. Caulking and caulking compounds (Section 07900)
12. Color charts and samples (Section 08400)
13. Interior and exterior plaques (Section 10426)
14. Sample signs (Section 10440)
15. Selection Samples (Section 13120)
16. Devices and wall plates (16140)

D. Additional submittals include:

1. Construction Schedule
2. List of Subcontractors, Laboratory Testing Agencies, and Surveying Companies.
3. Revetment construction procedures and written quality control plan (Section 02480)
4. Stone quality control results including check surveys at 2-week intervals (Section 02480)
5. Daily stone placement summaries (Section 02480)

E. The Contractor shall provide ODNR the submittals for the concrete, reinforcing steel information and bar schedule within 30 days of receipt of the notice to proceed.

1.14 ARCHAEOLOGICAL DISCOVERIES

A. The Contractor and subcontractors are required under O.R.C. Section 149.53 to notify the Ohio Historical Society and the Ohio Historic Site Preservation Board of archaeological discoveries located in the project area, and to cooperate with those entities in archaeological and historic surveys and salvage efforts if such discoveries are uncovered within the project area.

B. Contact Ohio Historic Preservation Office at 614-297-2470.

1.15 LAKE LEVELS

A. The dam and outlet works for Caesar Creek Lake are operated by the Louisville District Corps of Engineers. Caesar Creek Lake will be drawn down by the Corps of Engineers (USACE) for this phase of construction to allow near-shore construction and excavation to occur in dry conditions. The Louisville District office is located at Mazzoli Federal Building, 600 Dr. Martin Luther King, Jr Pl, Louisville, KY 40202. Contact phone number is (502) 315-6766.

B. Caesar Creek Lake will be drawn down by the U.S. Army Corps of Engineers (USACE) for this phase of construction to allow near-shore construction and dredging to occur in dry conditions.

C. The following schedule is anticipated for the drawdown.

1. Date drawdown is to begin: November 1, 2014

2. Target date by when the desired pool level shall be reached: December 31, 2014 (assumes an average drawdown rate of 4 inches per day).

3. Date refill may begin: April 25, 2015.

4. Target date the refill will meet the normal winter pool: May 29, 2015 (assumes an average refill rate of 2 inches per day).

D. Drawdown elevations

1. Drawdown will be a total of 13.0 feet, from the 848.25 ft NAVD88 summer pool to 835.25 ft NAVD88.

E. Flooding

1. Since the lake is used for flood control, lake levels can vary significantly and rapidly.

2. For information purposes, you can view the historic levels at the following web site: http://www.lrl.usace.army.mil/Missions/CivilWorks/WaterInformation/LakeInformation/YearlyLakeReport.aspx . Please note that the elevations shown on the lake level records are based on the Corps' datum and are thus approximately 0.75 foot higher than the elevations referenced on the drawings, which are based on NAVD 88.

3. The Contractor shall be responsible for any and all damage that may occur at the site as a result of changes in the pool level and shall replace or restore damaged structures or features of the work, whether of a permanent or temporary nature, at no additional cost to ODNR. The Contractor shall have no basis of claims because flood levels occurring during the construction period were unprecedented in magnitude or frequency.

1.16 VERTICAL DATUM

A. All vertical elevations on the contract drawings are referenced to NAVD88 datum.

B. Translation between NAVD88 and NGVD29 (datum used by USACE):

1. 836.00 ft NGVD29 = 835.25 ft NAVD88.

1.17 PROPERTY INFORMATION

A. The land upon which Caesar Creek State Park is located is owned by the USACE and leased to the State of Ohio and operated and maintained by the Ohio Department of Natural Resources (ODNR).

B. Ordinary High Water Mark of Caesar Creek Lake is 849.00 ft NGVD29 (848.25 ft NAVD88), below which are regulated Waters of the United States.

C. An 868-foot long straightened, unnamed tributary (ET1/ET2) runs along the northern edge of the project area and discharges into Caesar Creek Lake. An impounded pond used for

youth fishing (Young Angler's Pond) is located along the southern portion of the project area and discharges through a short, 110-foot long, unnamed tributary (ET3) into Caesar Creek Lake. Several low quality (Category I and II) wet meadow or scrub/shrub wetlands are located along the ET3 tributary, along the lake edge, or within a depressed area of the old field. The fishing pond and wetlands total 1.495 acres.

D. There is currently a floating patrol boathouse attached to the shore at the project site via a stiff-arm. The boathouse will be temporarily relocated by others for this phase of construction prior to the start of work. All upland infrastructure to serve the boathouse must remain protected throughout the duration of the work. Once water levels return to normal pool levels, contractor shall move patrol boat house from beach just north of project site and relocate to original location. Reconnection of the Boat house to the stiff arm shall be the responsibility of the Contractor.

1.18 REGULATORY REQUIREMENTS

A. ODNR is obtaining permits for the major construction work from the U.S. Army Corps of Engineers (USACE), Ohio Environmental Protection Agency (OEPA) and the ODNR. Bidders will have access to the permits once they have been obtained. Contractor is responsible for complying with all permit restrictions and requirements.

B. The following is a list of permits that are being obtained by the ODNR for this project:

1. USACE Section 404 permit
2. ODNR Section 401 certification
3. OEPA Notice of Intent to Discharge Stormwater from a Construction Site
4. Ohio Department of Commerce - Division of Industrial Compliance – Permit for the Floating Marina Services Building (Structural, electrical, plumbing, sprinkler, HAVC)
5. OEPA Permit to Install Wastewater System

C. The following is a list of permits that are to be obtained by the Contractor for this project:

1. Ohio Department of Commerce – Division of State Fire Marshall - Permit for the complete Fueling System
2. Ohio Department of Commerce - Division of Industrial Compliance - Permit for the Prefabricated Building (Fuel Attendant Building) Industrial Unit (pre-engineered structure)

1.19 CONTRACTOR'S QUALIFICATIONS

A. Manufacturer Qualifications for Dockage and Anchorage (Per Section 02488)

1. Documentation: List projects of similar scope, and type. Contractor must provide references for at least three projects of similar size and scope performed within the

past five (5) years. ODNR reserves the right to contact any and all references to obtain, without limitation, Contractor's performance on the listed projects.

Information provided for each project shall include:

a. Project Name and water level change
b. Client / Agency / Department / Office for Which Performed
c. Project Completion Date
d. Owner's Project Manager or Other Representative
e. Current Client Contact Person / Phone Number / Email Address
f. Dollar Value of Contract

B. Contractor or Subcontractor Qualifications for Emergent Plants (Per Section 02930)

2. Documentation: List projects of similar scope, and type. Contractor must provide references for at least three projects of similar size and scope as wetland plug planting (2 acre minimum installation) performed within the past five (5) years. ODNR reserves the right to contact any and all references to obtain, without limitation, Contractor's performance on the listed projects.

Information provided for each project shall include:

g. Project Name and Acreage
h. Client / Agency / Department / Office for Which Performed
i. Project Completion Date
j. Owner's Project Manager or Other Representative
k. Current Client Contact Person / Phone Number / Email Address
l. Dollar Value of Contract

C. Contractor or Subcontractor Qualifications for Wetland Seeding (Per Section 02922)

1. Documentation: List projects of similar scope, and type. Contractor must provide references for at least three project of similar size and scope as wetland mitigation / stream realignment area seeding (5 acres minimum) performed within the past five (5) years. The ODNR reserves the right to contact any and all references to obtain, without limitation, contractor's performance on the listed projects.

Information provided for each project shall include:

a. Project Name and Acreage
b. Client / Agency / Department / Office for Which Performed
c. Project Completion Date
d. Owner's Project Manager or Other Representative
e. Current Client Contact Person / Phone Number / Email Address
f. Dollar Value of Contract

D. Landscape Contractor Qualifications for Native Upland Seeding (Per Section 02925)

1. Documentation: List projects of similar scope, and type. Contractor must provide references for at least three projects of similar size and scope as project native upland seeding (5 acres minimum) performed within the past five (5) years. The ODNR reserves

the right to contact any and all references to obtain, without limitation, contractor's performance on the listed projects.

Information provided for each project shall include:

a. Project Name and Acreage
b. Client / Agency / Department / Office for Which Performed
c. Project Completion Date
d. Owner's Project Manager or Other Representative
e. Current Client Contact Person / Phone Number / Email Address
f. Dollar Value of Contract

D. Failure to submit the experience requirements as specified will delay notice of award and result in the Contractor's bid being considered non-responsive and cause for rejection of the bid.

1.20 TESTING LABORATORY SERVICES

A. The Contractor shall retain an independent testing laboratory agreeable to ODNR for conducting materials and field tests, as specified, to verify compliance with the specifications. The testing laboratory shall perform concrete tests, compaction tests of bases and backfill, sieve analyses of aggregate materials, approve material for and review concrete plant mixes, and conduct other tests as specified and directed by ODNR. Payment for the testing laboratory's services will be part of the contract allowance price for Bid Item 1, "Testing Lab".

B. Any test required by ODNR shall not relieve the Contractor from the responsibility of supplying certificates from manufacturers or suppliers to demonstrate compliance with the specifications.

C. The Contractor shall notify ODNR representatives prior to requesting any test by the testing laboratory, and no payment will be made under this item unless prior approval for testing is provided by ODNR.

D. Reports of laboratory tests shall be distributed to the Contractor and ODNR, unless otherwise stipulated in the specification section for the tested product.

1.21 COLOR VIDEO

A. The Contractor shall provide preconstruction photography to ODNR prior to beginning any of the construction work for the purpose of establishing the surface conditions existing in all of the areas to be affected. The ground photography shall consist of color video taping of surface features in all areas of work shown on the plans to a width covering all areas to be disturbed by a necessary operation. Prior to audio-video taping, all areas to be inventoried shall be investigated visually with notation made to items not readily visible by taping methods. The purpose of the photography is to provide necessary information for the restoration of surface features after completion of the project.

B. Such coverage shall include, but not be limited, to all existing sidewalks, roadways, trees, driveways, visible utilities, and landscaping within the influence of the proposed work. Audio description shall be made simultaneously with the taping of the video to document what the video is covering. The video shall be recorded in a standard digital video format and provided on a disc (CD or DVD).

C. All DVDs or CDs shall become the property of the ODNR. Any portion of the video deemed unacceptable shall be redone by the Contractor at no additional charge prior to beginning work.

1.22 EXISTING UTILITIES

A. In addition to Section 01100, Part 15, the following shall apply:

B. The locations of any existing above ground and underground utilities shown on the plans may not be correct or complete. ODNR makes no guarantee as to the location of such surface and subsurface items and the Contractor shall make no claim against ODNR or its Consultants for such incorrect information. It shall be the Contractors responsibility to locate these utilities and bring any conflicts to the attention of the ODNR. The Contractor shall utilize an Underground Utilities Identification Company to locate underground utilities prior to construction. Should the locations indicated prove inaccurate or should additional utilities be encountered, the Contractor shall advise ODNR immediately.

C. The Contractor will be responsible for protecting, securing, bracing or temporarily relocating all utilities to prevent damage during construction. Any utility damaged by the Contractor shall be repaired or replaced in kind to the satisfaction of ODNR and any regulating agencies at no additional cost.

1.23 QUANTITIES MEASURED FOR PAYMENT

A. Quantities measured for payment for unit price items will be made based on the neat lines shown on the drawings.

1.24 GRADES, LINES, LEVELS AND SURVEYS

A. In addition to Section 01100, Part 1, the Contractor shall verify all grades, lines, levels and dimensions as shown on the drawings and report any errors or inconsistencies in the above to ODNR before commencing work.

1.25 INSTRUCTIONS TO BIDDERS

A. General

1. Section 01010 – Summary of Work includes informational descriptions for the basis of bid items listed on the bid schedule. Bidders to include all materials, labor and equipment costs for the bid items listed. Failure to list an item in the description for each bid summary item does not preclude it from the project or the bid amount. Bidder takes full responsibility for including all work in the bid per the contract documents.

PART TWO – PRODUCTS

Not used.

PART THREE – EXECUTION

Not used.

END OF SECTION

SECTION 02012
SUBSURFACE CONDITIONS

PART ONE - GENERAL

1.01 DESCRIPTION

A. Soil test borings have been prepared for the site of this work by:

CTL Engineering, Inc.
Geotechnical Exploration
New Marina – Caesar Creek State Park
Waynesville, Ohio
February 29, 2012

1.02 USE OF DATA

A. Reports were obtained only for use in design and are not a part of the contract documents. The geotechnical report is attached to the contract documents as an appendix for informational use only.

B. The elevations indicated in the boring logs may vary from the topographic survey and should not be considered accurate without correction to the survey elevation at the designated boring locations.

C. Bidders should visit the site and acquaint themselves with all existing conditions. However, additional subsurface investigations will not be allowed prior to bidding. Any questions regarding the observed conditions or the previously-obtained borings shall be directed to ODNR.

D. The Contractor shall assume full responsibility for interpreting boring data and for the conclusions drawn from the information furnished, and from inspection of available information at the site.

PART TWO – PRODUCTS

Not used.

PART THREE – EXECUTION

Not used.

END OF SECTION

SECTION 02111
SITE PREPARATION

PART ONE– GENERAL

1.01 SUMMARY

A. This section includes protecting existing vegetation to remain, removing existing vegetation, clearing and grubbing, miscellaneous site removals, utility adjustments, salvage items, debris removal and disposal, as shown on drawings and specified herein.

B. Related sections

1. Section 02220 Site Earthwork

2. Section 02200 Soil Erosion and Sediment Control

1.02 REFERENCES

A. Council of Tree and Landscape Appraisers, Guide for Plant Appraisal, 9th Edition.

1.03 QUALITY CONTROL

A. Codes, Standards, Permits and Regulations

1. Demolition and site clearance is subject to all provisions of applicable local ordinances and regulations.

2. Observe all local codes, rules and regulations governing the respective utilities in executing the Work under this Section.

1.04 SITE CONDITIONS

A. General Site Protection

1. Protect from damage existing items indicated to remain by the erection of barriers or by other appropriate means to ensure protection.

2. Barricade all open depressions, excavations, pits and the like. Provide adequate barricades at all times conforming to local safety regulations. Remove barriers and fences when no longer required.

3. Maintain and keep public sidewalks, highways and streets in a condition satisfactory to local and/or state officials, and provide necessary watchmen if, and as required, in the use of public thoroughfares. Keep public sidewalks, highways and roads clean of spillage at all times.

B. Utility Protection

1. Verify location of and protect all existing utilities not designated to be removed from damage resulting from operations under the Contract.

2. Notify utility locator service (where applicable) for project area and have all existing buried utilities marked before site clearing activities commence.

C. Tree, Vegetation and Perimeter Protection Fencing

1. Protect all trees to remain within the Contract limit lines from damage or injury by any construction operation or equipment, from abuse by workers or any other danger that might arise as a result of this Work.

2. Erect tree protection fencing around trees and areas of vegetation to be protected and at work limits as shown on drawings. Fence may serve a combination of functions to provide construction site barrier and vegetation protection where locations coincide on drawings. Contractor must receive prior approval for any access required for areas within Vegetation Protection Fence from the ODNR Project Manager. No access shall be permitted to areas beyond Perimeter Protection Fence.

3. The following practices are prohibited within protection zones:
   a. Storage of construction materials, equipment, vehicles, debris, or excavated material.
   b. Vehicle or foot traffic.
   c. Parking vehicles or equipment.
   d. Foot traffic.
   e. Erection of sheds or structures.
   f. Impoundment of water.
   g. Excavation or other digging unless otherwise indicated.
   h. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
   i. Any other activity that would impact tree roots or cause compaction of ground around root systems.

4. Do not direct vehicle or equipment exhaust towards protection zones.

5. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

6. Promptly notify the ODNR Project Manager of trees damaged by construction operations and repair within 24 hours by a competent tree surgeon according to the ODNR Project Manager's written instructions. Damage applies to tree trunks, limbs and roots.

7. Tree Protection Fence shall remain in place for the duration of all construction as shown on the contract drawings for Phases 1A and 1B.

8. Remove and replace trees and shrubs indicated to remain that die or are damaged during construction operations that the RPR determines are incapable of restoring to normal growth pattern. Provide new trees of 2-inch caliper size and of a species selected by the RPR. Provide new shrubs as approved by the RPR. The Owner shall be compensated for the full value of trees damaged beyond repair. Value shall be determined by the Guide for Plant Appraisal, Council of Tree and Landscape Appraisers, as interpreted by a member of the American Society of Consulting Arborists.

D. Shoring and Bracing

1. Provide sheeting, shoring and bracing as required to prevent cave-ins, and to comply with local codes and ordinances having jurisdiction.

2. Provide shoring and protective measures as may be necessary to protect adjacent structures, facilities and utilities at all times. Contractor shall assume the responsibility for the adequacy of the design, installation and effectiveness of all shoring and other protective methods utilized, and repair damage resulting from failure to take adequate measures for protection of persons and adjacent property.

3. Construct shoring and bracing of sound material, accurately placed and securely braced. Maintain during period excavation is open. Remove when no longer required.

E. Environmental Protection

1. Wet down materials or use other suitable methods to limit the amount of airborne dust and dirt from the site to the lowest practical level.

2. Erosion prevention and sediment control shall be performed in accordance with Section 02200, and shall be in place prior to commencement of site clearing operations.

F. Site Maintenance

1. Maintain the site in a condition such that mobile construction equipment can move with its own power.

G. Soil Stripping, Handling, and Stockpiling

1. Perform in accordance with Section 02220 Site Earthwork.

PART TWO - MATERIALS

2.01 BLOCKING UTILITIES

A. Materials required for blocking and discontinuance of utilities shall be in accordance with local codes, rules and regulations governing the respective utilities.

2.02 FILL

A. Fill material shall be in accordance with Section 02220 Site Earthwork.

2.03 PROTECTION FENCE

A. Tree or Vegetation Protection Fence: UV stabilized high-density polyethylene barrier fence free of holes tears and other defects, 4’-0” tall fence in diamond or rectangular pattern. Fencing shall be “safety orange” color. Posts for temporary plastic barrier fencing shall be 5’ tall, minimum 12 gauge, painted metal posts. Method of erection shall not damage trees and shrubs to remain.

PART THREE - EXECUTION

3.01 CLEARING AND GRUBBING

A. Clearing: Remove trees not indicated to remain, shrubs, plants, crops and other above-ground vegetation.

B. Grubbing:

1. Excavate stumps, roots, and other on-ground and below-ground vegetation or organic debris and remove to a minimum depth below existing grade of 36 inches for stumps and 8 inches for roots, and other vegetative or organic debris.

2. Use only hand methods for grubbing within protection zones.

C. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated. Comply with Section 02220 Site Earthwork for filling and compaction requirements.

3.02 TREE & STONE SALVAGE FOR HABITAT AREAS

A. During site clearing and grubbing operations, the Contractor and RPR shall select trees targeted for removal that will be salvaged and reused for habitat structures as shown on drawings, or in use for future phases.

B. Trees to be salvaged will be reused as follows:

1. Logs only (trunks stripped of branches and root balls removed): 27 for use in Phase 1A habitat areas (cut into 8 to 10 foot lengths) and 9 for use in Phase 1B habitat areas (cut into 8 to 10 foot lengths). Diameter of logs to be 10 to 14 inches.

2. Trees with root balls that have had lateral branches stripped: 6 for use in Phase 1A habitat areas (30 feet long, tip to base of trunk). Diameter of trees to be 15 to 18 inches (minimum) at base of trunk and 10 inches (minimum) at tip of tree. Root ball mass shall have a minimum diameter of 6 feet, and shall be at least 75 percent intact.

C. Trees shall be tagged for reuse in accordance with the criteria listed. Salvaged trees for use shall be tagged and stored in a protected area on site.

D. Salvaged Cobble:

1. Contractor to salvage cobble stone from the existing shoreline to be used for cobble pile structures in fish spawning areas. Quantity of cobble to be salvaged shall be sufficient to create cobble piles as shown on the drawings.

3.03 UTILITY ADJUSTMENTS OR ABANDONMENT

A. General

1. Perform cutting, blocking and discontinuance of utilities in accordance with local codes, rules and regulations governing respective utilities.

2. Immediately notify utility companies involved so that demolition operations may proceed without danger to, or interruption of, said services for other property owners or liability to the Owner.

B. Abandonment of Manholes or Inlets

1. Remove the casting from existing manholes and inlets to be abandoned, and either reuse it on this Project, if approved by the RPR, or turn it over to the Owner for salvage.

2. Demolish and remove the cone, break and remove the walls to a depth necessary to accommodate new construction. Break up bottom to allow for drainage.

3. Plug all inlets and outlets with a minimum of a 12-inch brick and mortar or concrete plug. Place correcting pipe between inlet and outlet, properly connected, of any sewers that are to remain in use.

4. Fill the manhole or inlet with granular fill and provide compaction per 02220, Site Earthwork.

C. Adjustment of Existing Utility Covers

1. Existing utility structures, covers, frames and grates designated to remain shall be adjusted to meet future finished grade elevations.

D. Cathodic Protection

1. Do not remove cathodic protection system, including rectifiers, conduits, anode beds and test stations, without first notifying the ODNR Project Manager and utility companies.

3.04 SALVAGE, CLEAN UP AND DISPOSAL

A. Salvage Items:

1. Site salvageable items that will be removed by others prior to contractor mobilization are indicated on the Site Preparation Drawings. Castings from existing manholes shall be removed by the Contractor and surrendered to the Owner if requested.

B. Debris

1. Remove all debris found on the site or accumulated during performance of the Work.

2. All material required to be removed from the site shall be properly disposed of at an approved landfill. Contractor shall provide “Chain of Custody” documentation of final salvage or disposal of materials.

3. Items to be removed that are not indicated as salvage items shall become the property of the Contractor and shall be legally disposed of off the site.

4. Do not offer debris or other materials for sale on the Project site.

5. Burning of debris, except vegetative debris, will not be permitted on the site. Burning of vegetative debris, trees, stumps, roots or branches on the site will be permitted only under carefully controlled conditions. Secure all permits and approvals required from the local governing agencies and the ODNR. Burn vegetative debris at a location approved by the ODNR Project Manager and dispose of resultant ashes and debris off-site. Contractor to obtain any necessary permits for burning.

END OF SECTION

SECTION 02200
SOIL EROSION AND SEDIMENTATION CONTROL

PART ONE – GENERAL

1.01 SUMMARY

A. Measures to protect undisturbed areas and site improvements from soil erosion, and to reduce downstream sedimentation and/or accelerated runoff.

B. Related sections

1. Section 02220 Site Earthwork

1.02 REFERENCES

A. Ohio Department of Transportation (ODOT) Construction and Material Specifications, latest edition, herein referred to as “ODOT.”

B. Ohio Department of Natural Resources (ODNR) Rainwater and Land Development Manual (http://www.dnr.state.oh.us/tabid/9186/default.aspx), herein referred to as “ODNR RLD Manual.”

C. Ohio Environmental Protection Agency (OEPA) National Pollutant Discharge Elimination System (NPDES) Permit Program, herein referred to as “OEPA NPDES.”

1.03 SUBMITTALS

A. Product Data

1. Silt Fence Fabric and Stakes

2. Filter Sock

3. Stone Tracking Pad and Filter Fabric

4. Erosion Mat

1.04 REGULATORY REQUIREMENTS

A. The ODNR and RPR will prepare a Stormwater Pollution Prevention Plan (SWP3), submit a Notice of Intent, pay fees, and obtain coverage under the OEPA NPDES general permit for stormwater discharges from construction sites. Contractor may be asked to provide information relevant to the SWP3 as it relates to construction staging work.

B. The Contractor is responsible for following the requirements of the SWP3 and the OEPA NPDES permit.

C. The Contractor is responsible for meeting the requirements of all other State and Federal permits. Additional permits known to be obtained by the ODNR for this project include:

1. U.S. Army Corps of Engineers, Chapter 404 permit.

2. OEPA Section 401 Certification.

1.05 QUALITY ASSURANCE

A. In the event a Notice of Violation (NOV) is issued on this project, any and all fines will be the sole responsibility of the Contractor. The Owner will not participate in any payment or reimbursement for fines and will not authorize time extensions due to delays in project progress for work stoppage required to remedy the violations. If the Contractor does not make necessary corrections/adjustments in a timely manner as required above, the Owner will make repairs and recover the costs thereof from the Contractor. In the event deficiencies are not corrected within twenty-four hours after written notification by the ODNR Project Manager (unless documented conditions make a particular maintenance or repair activity impracticable immediately), a deduction shall be made from monies due the Contractor, not as a penalty, or as liquidated damages. This deduction shall be made for each location, as determined by the ODNR Project Manager, for each calendar day the deficiency is allowed to remain.

PART TWO – PRODUCTS

2.01 SILT FENCE

A. Provide materials in compliance with Chapter 6.3, Silt Fence, of the ODNR RLD Manual.

2.02 FILTER SOCK

A. Provide materials in compliance with Chapter 6.6, Filter Sock, of the ODNR RLD Manual.

2.03 STONE TRACKING PAD

A. Provide ODOT #2 (1.5-2.5) inch or recycled concrete equivalent in areas as shown on the drawings. The stone layer shall be at least 6 inches thick.

2.04 EROSION MAT

A. Slope Erosion Control Mat: Provide materials equivalent to “Curlex NetFree” manufactured by American Excelsior Company, www.americanexcelsior.com.

B. Channel Erosion Control Mat: Provide materials equivalent to “BioD-Mat 70” manufactured by RoLanka International, Inc., www.rolanka.com.

C. Fasteners for erosion mat shall be a natural-based plastic product that is 100% biodegradable from microbial activity in accordance to ASTM D5338 and ASTM D5271, formed in a T-shape with barbed head and shoulders, 6 inches long, and installed per manufacturer’s instructions.

PART THREE – EXECUTION

3.01 GENERAL

A. Comply with all requirements of Federal, State, and local regulations. Where the following unanticipated events result in the need for additional or modified soil erosion and sedimentation control installations to meet the objective of the referenced Act, provide such installation on a timely basis:

1. Unanticipated alterations to the Contract schedule when not dictated by the ODNR Project Manager.

2. Unanticipated weather conditions, except unusual natural occurrences such as tornado, 50-year storm, flood or fire.

B. Limits to clearing and grading shall be marked clearly on site by the Contractor before any grubbing or earth disturbing activity shall begin.

C. Disturbed areas that will remain inactive for a period of twenty-one (21) days or longer shall be temporarily stabilized with seeding and mulching, or other appropriate means, within seven (7) days after earth moving ceases. Permanent soils stabilization shall be installed within seven (7) days after final grade is reached on any disturbed portion of the site.

D. Stabilize areas within fifty (50) feet of the ordinary high water mark within two (2) days on all inactive disturbed areas that will remain inactive for fourteen (14) days or longer.

E. All sediment ponds, sediment traps, earthen diversions or embankments shall be seeded and mulched within seven (7) days of completed construction. Seeded areas shall be inspected and where the seed has not produced 80% cover shall be reseeded as necessary by the contractor.

F. Straw mulching shall be applied at a rate of 2-3 standard 45-lb. bales per 1000 sq.ft. of disturbed area or two (2) tons per acre. All hydroseeding must be straw mulched according to the above specifications unless it is watered weekly.

G. Sediment control shall be accomplished by seeding and mulching all disturbed areas immediately upon completion of excavation or fill and finish grading in accordance with specifications of the ODNR RLD Manual.

H. Sediment ponds, sediment traps, and perimeter sediment controls, shall be implemented as the first step of grading and within seven (7) days from the start of grubbing. They shall continue to function until disturbed areas are re-established with temporary vegetation.

I. Trench dewatering or ground water, which contains sediment shall pass through a sediment-settling pond or equally effective sediment control device. Alternatives may include dewatering into sump pit, filter bag or existing vegetated upslope area. Sediment laden water shall not be discharged to receiving waters.

J. Construction entrances shall be installed at all ingress and egress locations to eliminate off-site vehicle tracking of sediments. Sediments shall be removed from roadways daily to the

satisfaction of the ODNR Project Manager.

K. Maintain all erosion and sedimentation controls until the Contract has been completed and accepted. Such maintenance includes:

1. Repair of all damaged installations.

2. Replacement of lost facilities.

3. Periodic removal of collected silt and sedimentation as required or directed to maintain effectiveness of the silt traps, filters and basins.

3.02 SILT FENCE

A. Install silt fence per Chapter 6.3, Silt Fence, of the ODNR RLD Manual and Construction Details.

3.03 FILTER SOCK

A. Install filter sock per Chapter 6.6, Filter Sock, of the ODNR RLD Manual.

3.04 STONE TRACKING PAD

A. The construction entrance shall be installed as soon as is practicable before major grading activities.

B. A pipe or culvert shall be constructed under the entrance if needed to prevent surface water from flowing across the entrance or to prevent runoff from being directed out onto paved surfaces.

C. Top dressing of additional stone shall be applied as conditions demand. Mud spilled, dropped, washed or tracked onto public roads, or any surface where runoff is not checked by sediment controls, shall be removed immediately. Removal shall be accomplished by scraping or sweeping.

D. Stone tracking pads shall not be relied upon to remove mud from vehicles and prevent off-site tracking. Vehicles that enter and leave the construction-site shall be restricted from muddy areas.

E. Removal—the tracking pad shall remain in place until the disturbed area is stabilized or replaced with a permanent roadway or entrance. The tracking pad may transfer to the Phase 1B Contractor if necessary.

3.05 CLEANING

A. Remove temporary erosion control measures once areas are stabilized, as approved by the ODNR Project Manager. Erosion control measures which are required to remain for Phase 1B are identified on the drawings. Take care during removal to minimize siltation of nearby drainage courses.

END OF SECTION

SECTION 02220
SITE EARTHWORK

PART ONE - GENERAL

1.01 SUMMARY

A. This section includes excavation, placement of fill, compaction, grading, dredging lake bottoms in the dry (above the water level)and other earth-moving activities; geotextile fabrics associated with earthwork, and bedding and backfill for rigid pipe installation.

1.02 REFERENCES

A. American Society for Testing and Materials Standards, as referenced herein as ASTM.

B. Ohio Department of Transportation, Construction and Material Standards, latest edition, as referred herein as ODOT.

1.03 SUBMITALS

A. Product Data and Test Reports

1. Submit manufacturers' descriptive literature, detailed specifications, performance data, instructions and recommendations for installation of proposed geotextile fabrics.

2. Submit Certified Test Reports: Prior to construction, submit certified test reports for Contractor-supplied materials as listed in Part 1.03 A Laboratory Tests.

3. Field Test Reports: During construction, submit field test reports as listed in Part 1.03 B Field Control Tests.

1.04 QUALITY ASSURANCE

A. Laboratory Tests

1. The Contractor shall engage an independent testing agency to perform sampling and testing of soil materials proposed for use in the work and field testing facilities for quality control during earthwork operations.

2. For each on-site type of soil to be used for fill, the Testing Agency will conduct soil classification tests in accordance with ASTM D2487 and conduct moisture-density tests in accordance with ASTM D698.

3. For excavated material or other material proposed for use as fill by the Contractor, the Testing Agency will conduct mechanical analysis and consistency tests and determine the amount of non-durable and organic material. Tests may include ASTM D422 (Particle Size), D4318 (Liquid Limit, Plastic Limit and Plasticity), D1140 (Fines), or D2974 (Loss on Ignition).

4. After testing, the testing laboratory will inform the RPR in writing of its recommendations for compaction of the soil samples submitted for testing with one copy of each report sent to the

Contractor, ODNR Project Manager and the RPR. The Contractor shall comply with such recommendations.

B. Field Control Tests

1. The Testing Agency will:

a. Examine and document cut slopes, fill slopes and the presence of ground water within excavations.

b. Conduct field tests for density of subgrade soils in compacted fill areas and examine proof-roll of subgrade in cut areas.

c. Perform in-place soil density testing in accordance with ASTM D1556, sand cone method, or ASTM D2922 nuclear method. The compaction requirements indicated in Part 3.07 shall be verified by performing testing at a rate of not less than one test for each nine inch loose lift of fill for 2,500 square feet of building area (or two tests per lift in buildings less than 2,500 square feet) and 5,000 square feet of paved area. More frequent testing will be necessary within any undercut excavations.

d. Determine bearing capacity of the soil under foundations for site structures by use of appropriate testing means and methods.

2. When, in the judgment of the ODNR Project Manager or RPR, there is reasonable doubt about material characteristic of fill or backfill material used in field, a field-conducted one point Proctor test will be conducted. If the moisture-density coordinates of the one point Proctor test do not fall on the curve which has been established by laboratory tests, a sample of that material will be tested in the laboratory for conformance to the Specifications.

3. One copy of each test report will be submitted to each the Contractor, ODNR Project Manager and RPR. Reports will designate the location of the Work tested.

1.05 DELIVERY AND STORAGE

A. Deliver and store materials in a manner to prevent contamination or segregation. Storage areas will be as coordinated with the ODNR Project Manager.

1.06 SITE CONDITIONS

A. Site Information

1. Examine the site to ascertain the state and conditions under which the Work is to be performed.

2. See Section 02012 Subsurface Conditions for available subsurface data and use thereof.

3. Soil boring logs are available; however, the data on indicated subsurface conditions are not intended as representations or warranties of the accuracy or continuity between soil borings. The Owner will not be responsible for interpretations of conclusions drawn therefrom by the Contractor.

4. Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Owner. See Section 02012 for specific requirements.

5. Be responsible for interpreting boring data and for the conclusions drawn from the information furnished and from inspection of available information at the site.

6. Notify utility locater service for area where Project is located before beginning earth moving operations.

7. Do not commence earth moving operations until temporary erosion and sedimentation control measures are in place.

B. Use of Explosives

1. The use of explosives is not permitted.

C. Protection of Persons and Property

1. Barricade open excavations occurring as part of the Work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.

2. Protect utilities, pavements and other facilities from damage caused by settlement, lateral movements, undermining, washout and other hazards created by excavation operations.

PART TWO – PRODUCTS

2.01 SOIL MATERIALS

A. General

1. Provide soil materials which are free of debris, roots, wood, scrap material, vegetative matter, refuse, soft and/or unsound particles, frozen, deleterious or objectionable materials.

B. Topsoil

1. Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

C. General Site Fill

1. Unclassified, friable soil, without clods of clay and a maximum particle size of 6 inches in longest dimension (4 inches within 2 feet below rough grade).

2. Possesses the characteristics required for compaction to soil density specified for the location of intended use.

3. Minimum dry density: 105 pounds per cubic foot per ASTM D1557.

D. Granular Fill

1. Clean, free draining sand, or sand and gravel obtained from natural deposits meeting the general requirements of soil materials above, and classified as SW, SM or SP per ASTM D2487 and a maximum particle size of 3 inches in longest dimension.

2. Particles of material free of any objectionable coating.

3. Less than 10 percent passing a Standard No. 200 sieve when tested in accordance with ASTM D1140.

E. Granular Bedding and Backfill (for Pipe Installation)

1. Material excavated on the site of the Project or material supplied by the Contractor; clean natural sand, gravel or crushed stone meeting the following grading requirements:

Sieve Analysis (ASTM C136)

Total Percent Passing

(2")	(1")	(1/2")	(No. 4)	(No. 30)	(No. 100)
100	-	45-85	20-85	5-30	-

Percent Loss by Washing (ASTM C117): 0-5

F. Drainage Aggregate

1. Clean gravel or crushed stone, passing a 1.5-inch sieve and be retained on a .5-inch sieve.

G. Impervious Fill

1. Clay, silty clay or clayey silt meeting soil classifications CL, CH or MH when tested in accordance with ASTM D2487.

2. Minimum dry density not less than 110 pounds per cubic foot when tested in accordance with ASTM D1557.

H. Geotextile Fabrics

1. Filter Fabric:

For use in separation of RipRap/revetments and gravel. Synthetic, oven monofilament geotextilefabric that is resistant to chemicals and mildew, stable under freeze-thaw cycles, does not shrink or expand under wet conditions, does not unravel during use and meets the following criteria:

a. Min. Grab Tensile Strength ASTM D4632 305 lbs. min.

b. Min. Puncture Strength ASTM D4833 100 lbs. min.

c. Max. Apparent Opening Size (AOS) ASTM D4751 No. 30 U.S. Std. Sieve

d. Coefficient of Permeability ASTM D4491 0.40 cm/sec. min.

e. Min. Apparent breaking elongation, % ASTM D4632 15%

f. Suitable Products: US 230C (US Fabrics) FW300 (Mirafi)

2. Subsurface Drainage Geotextile (raingarden): Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; complying with AASHTO M 288 and the following, measured per test methods referenced:

a. Survivability: Class 3; AASHTO M 288.

b. Grab Tensile Strength: 110 lbf; ASTM D 4632.

c. Min. apparent breaking elongation: 130%; ASTM D 4632.

e. Min. Puncture Strength: 40 lbf; ASTM D 4833.

f. Apparent Opening Size: 300 μm, maximum; ASTM D 4751.

g. Permittivity: 0.70 per second, minimum; ASTM D 4491.

h. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

i. Suitable Products: US 120NW (US Fabrics)

PART THREE - EXECUTION

3.01 TOPSOIL STRIPPING

A. Preparation for Stripping

1. Remove from site heavy growth of grass, sod, decayed vegetation and other unsuitable material in the areas to be stripped.

B. Strip topsoil to depth of 9 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Conservation of Topsoil Suitable for General Site Use

1. Remove acceptable topsoil within the areas to be stripped and stockpile in areas approved by the RPR for reuse. Topsoil suitable for general site use is defined as the material presently supporting vegetation and having not less than 10 percent organic content. Existing site topsoil required for reuse on site shall originate from the upper 9” of the topsoil horizon in areas of deeper topsoil profiles. The contractor shall salvage sufficient quantities of this upper 9” layer for reuse on site as topsoil only. Areas with a topsoil horizon less than 2” shall not be salvaged for reuse. Areas with less than 9" of topsoil shall only be stripped to limit of the horizon.

2. Assure that topsoil suitable for general site use is stripped and stockpiled, is without admixture of subsoil, free of plants and their roots, stones larger than 6” diameter, and other undesirable material. Store topsoil separately from other excavated materials. Do not remove approved topsoil from the project site.

3.02 STRIPPING AND CONSERVATION OF TOPSOIL FOR WETLAND MITIGATION AREAS

A. Preparation for Stripping

1. Prior to stripping, the Contractor and RPR shall jointly inspect the existing wetland to verify the absence or presence of undesirable wetland plants. If undesirable plants are observed, the RPR will delineate these locations and this soil will be excluded from the topsoil stockpiled for reuse in the proposed wetlands.

2. Prepare areas to be stripped by removing heavy growth of grass and decayed vegetation. Cut all existing woody plants (trees and shrubs) flush with the ground and remove from site. Roots shall remain intact and become part of the wetland topsoil to be respread on site. Excessively large roots and stumps greater than 3 inches in diameter that will prevent proper stripping, handling, and spreading may be removed and disposed of offsite.

3. Contractor to minimize duration that wetland topsoil remains stockpiled.

B. Conservation of Topsoil Suitable for Wetland Areas

1. Strip and stockpile existing site wetland topsoil from the locations shown on the plans. Topsoil within the existing site wetlands varies in depth from 4 inches to 10 inches. Salvage only the upper 4 inches of this profile for use in proposed wetland areas; the remainder up to the 9-inch general salvage depth shall be stripped and stockpiled with topsoil suitable for general site use. The soil designated for reuse only in proposed wetland areas shall not be mixed with non-wetland topsoil or excavated subsoil. The purpose of this requirement is to assist the propagation of local native plants that exist in this topsoil as roots, live cuttings and dormant seeds in the proposed wetland areas. Therefore, admixture of plants and their roots, stones less than 4” diameter, and other material from the organic soil horizon is desired in this material. Stockpiled material shall not include admixture of subsoil.

2. Store wetland topsoil separately from other excavated materials. Do not remove approved topsoil from the project site.

3.03 EXCAVATION

A. Stockpiling Excavated Material Suitable for Filling or Backfilling

1. Stockpile excavated materials where directed until required for backfill or fill.

2. Locate and retain fill materials away from edges of excavations.

3. Dispose of excess soil material and waste materials.

4. Protect and maintain erosion and sedimentation controls during earth moving operations.

B. Drainage and Dewatering

1. Grade ground adjacent to excavations to prevent surface water from flowing into excavations. Cut ditches to cross sections and grades indicated.

2. Remove water accumulating in excavations to prevent softening of foundation bottoms or soil changes detrimental to stability of the subgrade.

3. Provide and maintain sufficient dewatering devices, such as pumps, hoses, strainers and other appurtenances, required to convey the water away from excavations.

4. Discharge water a sufficient distance from the excavations to prevent backflow. Maintain dewatering operations until backfill is placed, or as directed.

5. Dewatering, if any, shall be incidental to the Contract.

C. Unclassified Excavation:

1. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

D. Unauthorized Excavations

1. Take care not to excavate below the depths indicated.

2. Fill excessive or unauthorized excavation under site structures and footings with lean concrete.

3. Fill excessive or unauthorized excavation in other locations with compacted fill material as directed.

E. Stability of Excavations

1. Slope the sides of excavations to comply with local codes and ordinances having jurisdiction. Sheet, shore and brace where sloping is not possible either because of space restrictions or stability of material excavated.

2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

F. Shoring and Bracing

1. Provide temporary shoring, bracing, cribbing or sheeting as required to prevent undermining of structures, utilities, pavements and slabs, and to provide a safe work area in accordance with OSHA safety regulations at all times.

2. Assume the responsibility for the adequacy of the design, installation and effectiveness of all shoring and other protective methods utilized, and repair damage resulting from failure to take adequate measures for protection of persons and adjacent property. Supply installation and removal of any temporary support shall be incidental to the contract.

3. Construct shoring and bracing of sound material, accurately placed and securely braced. Maintain during period excavation is open. Remove when no longer required.

G. Frost Protection

1. Protect trenches and bottoms of excavations against freezing by means of insulating materials or heat as approved.

2. Revetment stone and bedding for revetment stone may be placed on frozen subgrade.

3. Stacked stone revetments may not be placed on frozen subgrade.

H. Additional Excavation

1. When excavation has reached required subgrade elevations, notify the Testing Agency, who will make an inspection of conditions.

2. If unsuitable materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed.

3. Removal of unsuitable material and its replacement as directed will be paid on the basis of Contract conditions relative to changes in the work.

H. Excavation for Structures

1. Excavate for site structures, such as, footings, walls and steps.

2. Trim excavation bottoms to required lines and grades, leaving a solid base to receive concrete.

3. Extend excavations a sufficient distance away from footings to permit placing and removal of forms, inspection of Work and installation of other Work.

I. Excavation for Utilities

1. Excavate to the elevations and dimensions indicated or otherwise specified. Keep excavations free from water while construction is in progress. Notify the ODNR Project Manager and RPR immediately if it becomes necessary to remove hard, soft, weak or wet material to a depth greater than indicated.

2. Make trench sides as nearly vertical as practicable except where sloping of sides is allowed. Do not slope sides of trenches from the bottom of the trench up to the elevation of top of the pipe, conduit or duct.

3. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated. Provide a minimum 12 inches clearance on each side of the pipe to the trench wall.

4. Excavate large rock, boulders and hard material to an overdepth at least 4 inches below the bottom of the pipe, conduit, duct and appurtenances, unless otherwise indicated or specified. Hand excavate deeper for bells of the pipe.

5. Use bedding material to refill over-depths to the proper grade and place in 6-inch maximum layers. At the option of the Contractor, the excavations may be cut to an over-depth of not less than 4 inches and refilled to required grade as specified.

6. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe, conduit, duct or structure on undisturbed soil or bedding material as indicated or specified at every point along its entire length, except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded and to dimensions as indicated and required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation.

J. Damages

1. Claims and repair costs for damages to off-site existing building walls or foundations due to the project earthwork operations is the responsibility of the Contractor.

3.04 ROCK EXCAVATION

A. Definition

1. Rock excavation is defined as excavation of boulders measuring more than 1 cubic meter (yard) in volume, and material that requires blasting before it can be removed by generally available excavation equipment, or shows a penetration resistance of at least 100 blows per 3 inches or less of penetration when tested in accordance with ASTM D1586.

2. Rock such as boulders or fractured rock pieces 1 cubic yard or less in volume, or weathered rock or hardpan that can be removed by a ripper, power shovel, hand tools or other generally available excavation equipment shall not be classified as rock excavation.

B. Blasting

1. Blasting is not allowed on site.

3.05 FILL

A. Placing

1. Prior to placing fill material the subgrade shall be prepared per Article 3.08.

2. Do not place fill material upon a frozen surface except for bedding stone for revetments may be placed on frozen surfaces.

3. Place fill materials in successive horizontal layers over the entire width and breadth of the section under construction. Each layer maximum thickness: 9 inches, loose measurement. After dumping, spread the fill material by approved means.

4. As soon as practicable after commencement of a fill section, raise or crown the central portion thereof with grades not to exceed 5 percent so that the surface will drain freely. Maintain drainage grades throughout construction until completed to indicated levels and grades.

5. During fill material placing operations, remove roots, trash, debris and all stones larger than 6 inches in maximum dimension, except 4 inches in longest dimension within 2 feet below rough grade.

6. Maintain the entire surface of a section under construction in such condition that construction equipment can travel on all parts of all sections. Fill ruts in surface before proceeding with compaction operations.

B. Compaction of Fill Layers

1. Compact each layer of fill material at optimum moisture content to the density specified under Article 3.06, Compaction Requirements. Prior to compaction operations, require the layer of fill material to be scarified, disked, harrowed or pulverized sufficiently to break down oversized clods.

C. Temporary Suspension of Work

1. If work is suspended more than 24 hours on a section receiving fill, the ODNR Project Manager may, as a protective measure, direct that the area be graded and compacted to prevent loss of moisture and to facilitate drainage. Before work is resumed in the area, require the surface to be scarified, watered or allowed to dry as required, and recompacted.

2. If compaction occurs in the fall or early winter and operations have ceased during the winter, require the surface to be rolled with a flatwheel roller, recompacted and sloped to allow runoff of surface water. Do not place equipment on the surface after the completion of the above operations until it is dry enough that rutting and remolding of the surface will not occur.

3.06 GENERAL GRADING

A. Grade excavated and filled sections, including transition areas, to provide positive drainage. Reshape graded areas over underground mechanical and electrical utilities provided under mechanical work and electrical work, and areas rutted or otherwise disturbed during construction operations to obtain uniform transition to adjacent areas or finish grades as indicated.

B. Grades not otherwise indicated: uniform levels or slopes between points where elevations are given, or between such points and existing grades.

C. Condition of finish surface: reasonably smooth, compacted and free from irregular surface changes.

D. Degree of finish to be ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified. Tolerance of finished surface: not more than 0.1 foot above or below the established grade or cross section. Hand-grade areas immediately adjacent to building walls and other structures to slope down away from building or structure for proper drainage.

E. Finish ditches so as to permit adequate drainage. Finish lawn areas to a smoothness suitable for the application of topsoil. Grade areas for paving and walks for proper drainage.

F. Protect newly graded areas from traffic and erosion. Before final acceptance of the work, repair and reestablish grades in settled, washed away or rutted areas.

3.07 COMPACTION REQUIREMENTS

A. Structural fill is defined as general site fill or granular fill located below or within 5 feet of any proposed structure, pavement or walk.

B. Moisture-Density

1. Compacted density at optimum moisture content as determined by moisture-density test in accordance with ASTM D698:

a. All structural fill shall be compacted to a minimum of 95 percent of the Standard Proctor maximum dry density except in building/pavement areas to receive in excess of ten feet of fill.

b. In any building/pavement areas to receive in excess of ten feet of structural fill, compact to a minimum of 98 percent of the Standard Proctor maximum dry density.

c. All fill located beyond 5 feet of any proposed structure, pavement or walk shall be compacted to a minimum of 90 percent of the Standard Proctor maximum dry density.

2. Maximum variation in moisture content in the compacted material, at the time of compaction, from the optimum moisture content for the material shall be two percent (+/-).

C. Moisture Control

1. Prior to compaction operations, provide the necessary equipment for adding moisture to the subgrade material and to each layer of backfill and fill material.

2. If moisture is required to be added to the surface of the subgrade or layer of backfill or fill material, uniformly apply and accurately measure water, and control application of water so that free water will not appear on the surface during or subsequent to compaction operations.

3. Allow material to dry that is too wet for compaction. Assist by discing, harrowing or pulverizing, until the moisture content is reduced to within the maximum variation from optimum.

3.08 EARTHWORK FOR UTILITY INSTALLATION

A. Bedding

1. Provide bedding for utility lines and utility line structures of the materials specified and to depths indicated.

2. Place bedding in 6-inch maximum loose lifts. Provide uniform and continuous support for each section of structure except at bell holes or depressions necessary for making proper joints. Do not use frozen bedding material.

B. Backfilling

1. Surround pipes, conduits and ducts with bedding or granular fill as indicated. Ensure that granular fill is placed completely under pipe haunches. Do not use frozen fill on the drawings. Ensure that no damage is done to structures or protective coatings thereon.

2. Place granular fill in 6-inch maximum loose lifts to 1 foot above pipe or other utility, unless otherwise specified. Bring up evenly on each side and for the full length of the structure.

3. Place general site backfill in 8-inch maximum loose lifts, unless otherwise specified.

4. Compact each loose lift as specified in Article 3.07 Compaction, before placing the next lift.

5. Do not backfill in freezing weather where the material in the trench is already frozen or is muddy.

6. Where unacceptable settlements occur in trenches and pits due to improper compaction, excavate to the depth indicated by the Testing Agency, then backfill and compact the excavation as specified herein and restore the surface to the required elevation.

7. Coordinate backfilling with testing of utilities. Assure that testing for water distribution, storm drainage and sanitary sewer systems is complete before final backfilling.

C. Compaction

1. Use hand-operated plate-type vibratory or other suitable hand tampers in areas inaccessible to larger rollers or compactors. Be careful to avoid damaging utilities and protective coatings. Comply with the following, unless otherwise specified:

a. Bedding: Compact to 95% of ASTM D1557 maximum density.

b. Granular Backfill Surrounding Pipes, Cables, Conduits or Ducts: compact to 95% of ASTM D1557 maximum density.

c. General Site Backfill: Compact to 90% of ASTM D1557 maximum density.

3.09 SPECIAL EARTHWORK REQUIREMENTS

A. Subgrade Compaction

1. Thoroughly loosen the top 8 inches of subgrade to be compacted by scarifying or plowing. Remove roots and other debris turned up by such loosening. Compact the loosened subgrade at optimum moisture content to the density specified for each class of area under Part 3.06 Compaction Requirements using approved equipment.

B. Unsuitable Material

1. Remove material found unsuitable for compaction to a depth as determined by the Testing Agency and replace with suitable material. Removal and replacement of material will be paid for in accordance with the contract conditions relative to changes in the work.

C. Backfilling for Structures

1. Backfill Materials

a. Material for backfilling excavations and depressions below or within 1.0 foot of site structures: granular fill.

2. Placing Backfill

a. Before backfilling is placed against structures, remove forms, trash and debris.

b. Place backfill material in uniform layers and symmetrically on all sides of structures. Maximum thickness each layer: 9 inches.

c. Moisture-condition and compact each layer with mechanical or hand tampers to density specified under Part 3.07 Compaction Requirements. Carry the backfill up to the surface of the adjacent ground and neatly grade its top to slope away from building or structure for proper drainage.

d. Do not operate power-operated earth moving equipment closer to foundation walls or other structures than a distance equal to the height of backfill above the top of footing to the ground surface.

D. Abandoned Underground Services

1. Remove abandoned underground pipe, conduit, and other services as indicated on the Contract Drawings to accommodate new Work. Do not remove such abandoned services until disconnected from remaining active services. Seal open ends of abandoned pipe left in place with concrete.

E. Wetland Areas

1. The Contractor shall be responsible for accurate construction of all wetland areas in accordance with the plans, specifications, and these notes. Grading and layout tolerances for the wetlands are different than for the general site grading. The Contractor shall be required to conform to the following layout and grade tolerances outlined below:

a. As-built layout accuracy shall be within 6" of horizontal plan locations and within 1" of specified spot elevations.

b. All areas shall be kept dry until approved by the RPR. Once the work is accepted, water will be allowed to accumulate to within 12" of the upper limits of the accepted work. The RPR will conduct the one inspection of the finish grades for all wetland areas.

c. The Contractor shall retain the services of an independent licensed surveyor to provide layout and elevation verification for all grade approvals. The surveyor shall submit

electronic copies of record drawings accurately depicting the location of all finish grades ready for the RPR's approval. The record drawings shall be horizontally referenced to the Ohio State Plane (NAD83) Coordinate System and vertically referenced to NAVD88. When setting subgrade and finish grade survey stakes in the field for review, the surveyor shall include layout coordinates and proposed and actual as-built elevations on each stake. The surveyor shall provide the following field layout and grading information for review and approval by the RPR:

- For all wetland areas, set finish grade stakes at 50-foot spacing and at all curve tangent points.

3.10 EROSION PREVENTION AND SEDIMENT CONTROL

A. Refer to Section 02200 for Soil Erosion and Sediment Control.

B. Provide temporary soil erosion control to eliminate sedimentation from entering sewers and open ditches.

C. Remove sediment caused by accelerated soil erosion from runoff water before it leaves the site.

D. Maintain temporary soil erosion control measures until permanent soil erosion control measures are implemented.

E. Promptly remove soil, debris or other material spilled, dumped or otherwise deposited on public streets, highways or other public thoroughfares during transit.

3.11 FINISH OPERATIONS

A. Grading

1. Site grading plans included herein indicate finish grades. All areas outside the grading limits, including designated existing wetlands and vegetation, shall remain undisturbed. Grades shall blend into existing grades at contract limits.

2. Tolerance: within 1" of grade on lawn and natural areas and to within 1 inch of a tightly pulled 25 foot string in any direction. Grades shall be ½ inch lower than adjacent pavement surface. Grade areas to drain water away from structures. Grade as directed existing grades which are to remain, but are disturbed by Contractor's operations.

3. Grades shall slope to drain, be free of depressions or other irregularities after thorough settlement and compaction of soil, and shall be uniform in slope between grading controls and the elevations indicated.

B. Protection of Surfaces

1. Protect newly graded areas from traffic, erosion and settlements that may occur. Repair or reestablish damaged grades, elevations or slopes.

3.12 DISPOSAL OF SURPLUS OR UNSUITABLE MATERIAL

A. Unsuitable Material, Debris and Refuse

1. Dispose of excess excavated material or material unsuitable for filling or grading operations, trees not indicated to remain on site, stumps, debris, miscellaneous refuse and other items indicated to be removed, off the Owner's property in compliance with local codes and ordinances.

END OF SECTION

SECTION 02480
STONE REVETMENT

PART ONE - GENERAL

1.01 SUMMARY

A. Section Includes: Riprap shore protection, stacked stone shore protection, in-stream stone structures, streambed cobble, and geotextile fabric associated with stone revetments.

1.02 REFERENCE

A. Ohio Department of Transportation Construction and Materials Standards, latest edition, as referred to herein as ODOT.

B. ASTM International, as referenced herein as ASTM.

1.03 SUBMITTALS

A. At the initial preconstruction meeting, submit intended revetment construction procedures and quality control plan. These shall contain the following information as a minimum:

1. Placement equipment for each stone classification.

2. Anticipated placement and delivery rates for each stone classification.

3. Survey control and check survey procedures.

4. Stone quality control procedures.

B. Prior to ordering stone materials, submit samples of all exposed stone to be used on the project including riprap, stacked stone and in-stream stone structures. Samples shall represent the actual products, colors and textures of the stone to be used in the Work.

1. Riprap samples shall include a sufficient number of stones to represent the typical variation in color and size of the riprap to be used, but include no less than 10 stones total.

2. Stacked stone samples shall include a sufficient number of stones to construct an 8-foot wide mockup section as described in Paragraph 1.04B.

3. Samples shall be delivered to the site for approval by ODNR and the RPR. The date of the sample review shall be included in the Contractor's construction schedule and in the revetment construction procedures described in Paragraph 1.03A.

C. All required test data for stone produced for the project.

D. Manufacturer's stone gradation for riprap and bedding stone.

E. Manufacturer's data on filter fabric.

F. Immediately after the start of stone production and at two week intervals thereafter, submit stone quality control results of all visual inspections, gradation tests, check surveys and a written summary report.

G. Submit daily placement summaries described in Part 3.03, Placement.

1.04 QUALITY CONTROL

A. Stone Quality and Gradation

1. The Contractor is responsible for, and shall establish and maintain, quality control for all work performed at the quarry and at the job site to ensure compliance with the specifications. A written quality control plan shall be submitted to the ODNR Project Manager for approval prior to material production.

2. The Contractor shall provide a quarry inspector for each stone source. The inspector's responsibilities shall be to ensure that all stone meets the quality and gradation specifications.

3. A visual test shall be made at the quarry for elongation, cracks, deterioration and other defects visible to the naked eye on at least two-thirds of the surface area of the stone.

4. Ten percent of the stone checked for cracks shall be wetted and reinspected for minute cracks to determine if they would be detrimental to the stone quality and if additional inspections are necessary on all stone. Stones with cracks that are detrimental to a long-lasting product shall not be shipped to the project site.

5. Visual inspections shall be conducted by the RPR on a periodic basis. If at any time the stone quality changes such that the requirements of the specifications are not achieved, this shall be cause for rejection.

6. The Contractor shall conduct bi-weekly stone gradations. Gradations shall be conducted by taking a random sample of stone equal to at least 30 times the average stone weight, weighing each individual piece and recording in table format such that a gradation curve may be assembled.

7. The RPR and ODNR Project Manager reserve the right to inspect the quarry operations at any time to check for compliance to the specifications.

B. Test Section

1. General

a. The initial revetment sections for each typical cross section will be considered as a test section. The purpose of the test sections will be to establish an in-the-field standard, built in accordance with the requirements of the contract documents, to which the remainder of the revetment shall be constructed. The Contractor will make whatever modifications are necessary to placement procedures such that this standard will be achieved consistently during construction of the remainder of

the revetment. Based on these solutions, the RPR may make modifications to the revetment cross section dimensions.

2. Length

   a. Test section for riprap revetment shall be a minimum of 20 feet long.

   b. Test section for stacked stone shall be a minimum of 8 feet long.

3. Execution

   a. The Contractor shall lay out the work, provide survey control, and perform check surveys in accordance with the requirements of this section and the dimensions shown on the drawings.

   b. The Contractor shall make every effort to place the stone to the lines, grades and course thicknesses shown on the drawings. Intentional over-building or under-building to influence estimated stone quantities will constitute the basis for rejection and reconstruction of the test section.

   c. The Contractor's equipment and methods for handling each classification of stone shall be such that all placement requirements of this section are satisfied.

   d. The Contractor shall account for the approximate stone tonnage placed in the test section in the manner specified in this section.

4. Approval

   a. The Contractor will be required to rework deficient portions of the test section to meet these requirements. If during construction of the test section, it becomes evident that the Contractor cannot achieve the required neat lines and course thicknesses due to the type of stone being used, modifications to the section will be made. Upon approval, the test section can be incorporated into the remaining work such that removal will not be necessary.

5. Modifications

   a. The RPR will observe the Contractor's survey techniques to verify that they are in accordance with standard survey practice and the requirements of these specifications. The Contractor will make changes to its survey techniques as necessary, or as directed by the ODNR Project Manager, such that stone placement is adequately controlled and measured cross sections accurately define the limits of the stone in place.

   b. The Contractor will make any necessary modifications to placement equipment and procedures to achieve the specified in-place requirements.

   c. The Contractor will not be allowed to alter its unit bid prices for stone materials if such modifications occur.

C. Survey

1. General

a. Contractor shall maintain records of all quality control tests, surveys, inspections and corrective actions, and submit copies to the ODNR Project Manager and RPR.

2. Survey Control

a. The Contractor shall provide range poles, marker buoys, templates, batter boards, and/or any other means of guidance and control as necessary to construct the stone courses to the required tolerances.

b. The Contractor shall maintain temporary vertical and horizontal control monuments and staff gauges in the immediate vicinity of the work being performed.

3. Check Surveys

a. The Contractor shall perform check surveys as the work progresses to verify that lines, grades and thicknesses for the completed work are within the specified tolerances.

b. The Contractor shall provide all boats, personnel and equipment necessary to adequately and safely perform check surveys.

c. Check surveys for each stone course shall consist of cross sections performed by the Contractor at intervals of 25 feet or at intervals approved by the RPR. Check survey locations shall be referenced to stations along the revetment reference line. Individual cross sections shall be measured perpendicular to a tangent on the reference line. Using a surveyor's tape or tag line for each cross section, measurements shall be taken every 5 feet and at any change in grade. Additional elevations and soundings shall also be taken as the RPR may deem necessary or advisable. The check surveys shall be conducted in the presence of the RPR, unless otherwise waived.

d. Check surveys conducted above the water surface shall be determined by the use of a leveling instrument and an elevation rod having a base of 12 inches in diameter. The elevation of each point should represent the average elevation of the surrounding area encompassed by a 2.5 foot radius circle whose center is the exact point. The intent of this is to obtain the average elevation, not the elevation of a void or high point.

e. Elevations below the water surface shall be determined in the same manner as those above water or by soundings. Soundings shall be performed using a sounding pole or lead line with a sounding basket weighing approximately 8.5 pounds. Either sounding instrument shall have a 12 inch diameter base.

f. The check survey record shall contain the following information as a minimum:

- check survey location (revetment station)
- stone course surveyed

- date and time of survey
- weather conditions
- water elevation at time of survey
- names of participants
- bench mark location and elevation
- instrument height
- rod readings (nearest 0.1 foot)
- distance readings relative to reference line (nearest 0.5 foot)
- any off-sets from reference line

The exact format of the check survey record will be agreed upon by the ODNR Project Manager and Contractor.

g. Check surveys are to be plotted at the same scale as the contract drawings and are to be delivered to the ODNR Project Manager and RPR no more than two working days after the completion of each 100 foot long section of revetment.

h. Before placement of riprap stone, the bedding stone shall be approved by the RPR.

1.05 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall exercise care in the transportation of all stone materials to prevent cracking, splitting, spalling etc. that would otherwise lead to rejection at the job site.

B. The Contractor shall handle and store bedding stone material to ensure that stockpiles are not contaminated with other soils and materials, and to limit the segregation of material sizes.

C. The Contractor shall handle and store filter fabric in accordance with the manufacturer's recommendations.

PART TWO - PRODUCTS

2.01 GENERAL

A. All materials to be furnished shall meet all requirements in this section of the specifications. The ODNR Project Manager or the RPR, at any time during the contract, may reject materials at the source or at the job site for failure to meet the specified requirements. Materials that have been delivered to the Project site and are rejected, whether in stockpile or in place in the structure, shall be removed from the Project site at the Contractor's expense.

B. All riprap shall have a minimum specific gravity of 2.65 based on water having a unit weight of 62.4 pounds per cubic foot. In-stream stone structures and stacked stone blocks shall have a minimum specific gravity of 2.65.

C. Furnish stone that is free of laminations, seams and fractures, or injury due to blasting.

D. Stone used for riprap, stacked stone and in-stream structures shall be dolomitic limestone with predominately tan undertones and minimal striations or variations in color.

E. All stone used on the project (other than salvaged stone and bedding stone) shall be sourced from the same quarry with the resources to provide materials of consistent quality in appearance and physical properties. Color, appearance, and physical properties shall be uniform for all visible stone including riprap, stream bed stone, and stone blocks.

2.02 STONE GRADATIONS

A. Material having the gradations listed below shall be placed in the Work at the locations as shown on the Contract Drawings. Gradation limits are in-place requirements. Adjustments in production, transportation and placement methods shall be made as necessary to ensure final placed materials are within specified ranges. All gradations produced shall be well graded. A minimum of one gradation check for each gradation produced shall be run during initial production each year. Additional checks may be done by visual inspection if no gradation problem exists.

B. Riprap and Bedding Stone

1. Riprap

a. Gradation:

Designation	Size Range	85% by Weight	50% by Weight
Rip Rap	9 - 18 inch	> 9 inch	> 15 inch

b. Test for soundness according to ASTM D 5240. Use materials having a maximum 30 percent single slab loss and a maximum 20 percent cumulative loss. ODNR may waive testing for materials or sources that have a known durability or can provide proof of testing.

2. Bedding stone

a. Gradation shall be ODOT Size No. 1 from Table 703.01-1, which is as follows:

Sieve Size	Total Percent Passing, by Weight
4 inch (100 mm)	100
3 1/2 inch (90 mm)	90 to 100
2 1/2 inch (63 mm)	25 to 60
1 1/2 inch (37.5 mm)	0 to 15
3/4 inch (19.0 mm)	0 to 5

b. Physical properties (per ODOT Item 703.19):

Percent of wear, Los Angeles Test, maximum (CCS or gravel)	50 %
Loss, sodium sulfate soundness test, maximum (except for RPCC)	15 %
Percent by weight of fractured pieces minimum (CCS or gravel)	90 %
Loss for RPCC, AASHTO T 103 Soundness of Aggregates by Freezing and Thawing	20 % [1]
[1] Use Method C using 25 cycles.	

CCS = crushed carbonate stone
RPCC = recycled Portland cement concrete

C. Stacked Stone Blocks

1. Dimensions:

Height: 12” for all layers except bottom layer; 18” for bottom layer
Depth: 48”
Length: Random lengths varying from 36” to 60”

2. All abutting stone sides (sides, tops and bottoms)shall be shaped to allow for tight fitting joints without voids . All exposed faces shall have a natural weathered appearance.

D. Stone for In-Stream Structures

1. Stone used for in-stream structures such as j-hooks and cross vanes shall be boulders of relatively uniform size and shape, rounded or angular, with no dimension that is greater than two times the smallest dimension. The top layer of stone used for in-stream structures shall have an average diameter of 10 to 15 inches. The lower two layers of stone shall be equal to or larger than the top layer of stone, but no greater than 20 inches in any dimension.

E. Streambed Cobble

1. Narrowly graded mixture of washed natural or crushed stone; ASTM D 448; with 100 percent passing a 3-inch sieve and 0 to 5 percent passing a 1½-inch sieve.

2.03 STONE QUALITY AND SOURCES

A. Riprap, in-stream stone and stacked stone blocks shall be obtained from sources that have been previously approved by the US Army Corps of Engineers (USACE) or ODOT.

B. All stone shall be highly resistant to weathering and disintegration under freezing and thawing, and wetting and drying conditions, and shall be of a quality to insure permanence of the structure in the climate in which it is to be used. The stone shall be durable, sound, free from

detrimental cracks, seams, and other defects which tend to increase deterioration from natural causes or cause breakage in handling and/or placing.

C. The rock fragments shall be angular to sub-rounded in shape. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment for a minimum of 90% of the stone.

D. Quarry operations shall be conducted by the Contractor/Supplier in a manner that will produce stone conforming to the requirements specified and may involve selective quarrying, handling, and loading as necessary.

E. Stockpiling shall be in lifts no more than 5 feet high, avoiding segregation.

2.04 FILTER FABRIC

A. Filter fabric shall be a woven monofilament geotextile and meet the following minimum physical property requirements:

a. Min. Grab Tensile Strength ASTM D4632 305 lbs. min.

b. Min. Puncture Strength ASTM D4833 100 lbs. min.

c. Max. Apparent Opening Size (AOS) ASTM D4751 No. 30 U.S. Std. Sieve

d. Coefficient of Permeability ASTM D4491 0.40 cm/sec. min.

e. Min. Apparent breaking elongation, % ASTM D4632 15%

f. Suitable Products: US 230C (US Fabrics) FW300 (Mirafi)

PART THREE - EXECUTION

3.01 QUARRY OPERATIONS

A. Quarry operations shall be conducted by the Contractor/supplier in a manner that will produce stone conforming to the requirements specified, and may involve selective quarrying, handling and loading as necessary. Blasting and handling of rock shall be controlled by the Contractor/supplier to produce stone of the size ranges and quality specified. Techniques such as the use of proper hole diameter, hole depth, hole angle, burden and spacing distances, types and distribution of explosives, delay interval and sequence, removal of muck piles between each shot and special handling techniques will be required as necessary to produce the specified materials. All specifications of blasting operations shall be specifically designed so that the end product is not damaged from the blasting technique and that the stone is suitable for the intended purpose.

B. The Contractor shall submit, in writing, to the RPR the anticipated production rates for the various types of stone materials. If the production rates change significantly such that delays are caused at the job site, the RPR shall be notified in advanced writing with the reason for the delay.

3.02 CURING STONE

A. All sedimentary quarry stone from any source shall be stockpiled at the quarry a minimum of 48 hours prior to shipment to the project site. No stone production shall be allowed during freezing temperatures; unless quarry history is available to ensure that durable stone can be quarried in freezing temperatures.

3.03 PLACEMENT

A. General

1. The neat lines represent the limits of the riprap stone and the bedding stone for revetment construction as shown on the Contract Drawings.

2. Placement of all stone materials shall not deviate from the neat lines as shown on the drawings by more than the tolerances described in this section, unless directed by the ODNR Project Manager.

3. Approval of placement and/or check surveys for any stone set, or portion thereof, does not constitute final acceptance. The stone work will be considered substantially complete when the ODNR Project Manager and RPR has approved placement and check surveys for all sets comprising the total length of revetment work for the project. Any damages to approved sets prior to substantial completion, due to Contractor or subcontractor operations, wave activity, or otherwise, shall be repaired by the Contractor at no additional cost to the Owner.

B. Filter Fabric Placement

1. Placement of filter fabric shall conform to manufacturer's requirements to assure a continuous layer unbroken by rips, tears, punctures, or other physical damage from placement of the fabric or placement of materials over the fabric.

2. Seams between individual pieces of filter fabric shall be joined or overlapped to provide a continuous layer. To the maximum extent possible, seams should be joined in the shop. Fabric shall be overlapped at a minimum of 18 inches at all longitudinal joints and a minimum of 36 inches at all tranverse joints.

C. Bedding Material

1. Equipment suitable for handling bedding material of the specified gradation shall be used.

2. The stone shall not be dropped from a height exceeding 2 feet above the surface upon which it is being placed.

3. All material shall be placed uniformly within the lines and grades indicated on the drawings and within the tolerances described in this section.

4. The method used in placement shall be such that any soft subgrade materials will be displaced outward towards the extreme outside toes of the required sections of the structure and in the direction of the construction.

5. The material shall be handled and placed in such a manner as to minimize segregation and provide a well-graded mass.

6. Shaping and finishing to the required tolerances, as well as check surveys, shall be performed immediately prior to the commencement of riprap stone placement.

7. At the end of each day that bedding material is placed, the Contractor will provide a Bedding Placement Summary to the ODNR Project Manager and RPR. The exact format of the Bedding Placement Summary shall be determined and agreed upon by the RPR and Contractor prior to commencement of bedding stone filter placement. This summary shall include as a minimum: the tonnage of bedding material placed; the revetment stations between which bedding material was placed and; total bedding placement time.

D. Riprap and In-Stream Stone Structures

1. The stone shall be placed by equipment on the surfaces and to the depths specified on the drawings. The riprap shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The stone shall be delivered and placed in a manner that will ensure that the riprap in place shall be reasonably homogeneous with the larger stones uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks.

2. Riprap shall be placed in a manner to prevent damage to structures and bedding spread over the geotextile fabric. Hand placing may be required to the extent necessary to prevent damage to the permanent work, but will not be a separate pay item.

3. At the end of each work day that riprap stone is placed, the Contractor will provide a Riprap Stone Placement Summary to the ODNR Project Manager and RPR. The exact format of the Riprap Stone Placement Summary shall be determined and agreed upon by the RPR and Contractor prior to commencement of armor placement. This summary shall include as a minimum: a tally of stone placed; the stations between which stones were placed; and total riprap placement time.

E. Stacked Stone Blocks

1. The stone shall be placed by equipment on the surfaces and to the depths specified on the drawings. Stone blocks shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. Hand placing may be required to the extent necessary to prevent damage to the permanent work, but will not be a separate pay item.

2. The stone blocks shall be placed such that the outer face of each layer is uniform and smooth in appearance, with no deviation between adjacent stones. Stones shall be cut and set as tightly as possible to minimize cracks between adjacent stones to 1” or less.

3. The stone blocks shall be placed so that each layer fits snugly on the layer below, and in such a manner that the top face of each layer is level and smooth without any dips or deviations. Stagger joints in each stone layer so that a vertical joint does not match up between two adjacent layers. Maximum spacing between vertical layers shall be 1” or less.

4. Contractor to shape the bottom and sides of stone blocks for a tight fit with the adjacent blocks.

3.04 TOLERANCES

A. The finished surface and stone layer thickness shall not deviate from the lines and grades shown on the drawings by more than the tolerances listed below. Tolerances are measured perpendicular to the indicated neat lines. Extreme limits of the tolerance given below shall not be continuous in any direction for more than five times the median stone dimension and/or for any area greater than 1,000 square feet of the structure surface. Any section of a stone course built to the upper tolerance limit shall not be immediately adjacent to a section built to the lower tolerance limits and vice versa (i.e., transitions between extreme tolerance limits shall be smooth).

Material	Above Neat Line	Below Neat Line
Riprap and in-stream stone	6 inches	6 inches
Bedding for riprap	6 inches	6 inches
Subgrade	3 inches	3 inches
Stone Blocks	1 inch	1 inch

B. In addition to the vertical tolerances above, the horizontal alignment for the finished stone courses shall be ±1 feet from that shown on the drawings provided lines, arcs, curves and transition zones are smooth and continuous without visible deflections, bends, kinks, etc. The horizontal tolerance for the landward edge of the riprap stone crest adjacent to the reference line shall be 1 foot.

C. The intention of the above tolerances is that the work will be generally built to the required elevation, slopes and grades, and that the outer surfaces shall present a neat and aesthetic appearance. Placed material not meeting these intentions shall be removed and/or reworked to the satisfaction of the ODNR Project Manager and RPR. Material beyond the upper tolerance limit permitted to remain in place by the ODNR Project Manager and RPR will not be paid for, as discussed previously in this section.

D. Tolerances will be discussed and agreed upon during the construction and approval of the test sections.

END OF SECTION

SECTION 02488
FLOATING DOCKS AND GANGWAYS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements stated in Division 0 and Division 1 of these Specifications shall apply to all work in this Section.

1.2 DESCRIPTION OF WORK

A. This item shall consist of furnishing all labor, equipment, and materials necessary to design, construct, and deliver to the site, and install the floating docks, gangways, wave attenuator, and dock/attenuator anchoring systems as shown on the detailed drawings and specified herein.

B. This Section is a Design/Build specification and contains performance requirements for the dock system.

1.3 DOCK MANUFACTURER

A. Dock manufacturing is to be performed in accordance with these specifications and shall be accomplished by one firm, qualified by actual consistent dock manufacturing experience.

B. Qualifications:
1. The Manufacturer shall have not less than five years continuous experience in the fabrication of floating dockage.
2. The Manufacturer shall demonstrate to the ODNR successful floating dockage installations in a similar physical and natural environment with the same wave conditions as stated below with at least one hundred (100) boat slips.
3. The Dockage Designer shall be an Ohio Licensed Professional Engineer and shall submit at least three references for marina floating dockage & dockage anchoring systems designed by him/her. The ODNR shall review references and has the right to refuse or reject the dockage and/or anchoring designer. Dockage manufacturing shall not commence until the Dockage Designer is approved by the ODNR.

C. Pursuant to R.C. 9.312, ODNR may consider all of the following factors in determining whether the manufacturer is responsible: the experience of the manufacturer, the manufacturer's financial condition, the manufacturer's conduct and performance on previous contracts, the manufacturer's facilities, the manufacturer's management skills, and their ability to execute the contract properly. Upon request by ODNR, a bidder shall promptly submit any additional information which will assist ODNR in evaluating the proposal.

D. The floating docks shall be fabricated under controlled conditions.

E. The dock manufacturer shall have a written quality assurance (QA) program, which covers all aspects of components and final assemblies, furnished on this project.

F. All welding shall be done by certified welders, with AWS certifications appropriate for the welds specified.

G. The dockage shall be designed by an Ohio registered professional engineer experienced in floating dock and anchoring design using the criteria set forth below in the project plans. Upon request by ODNR, a bidder shall promptly submit any additional information which will assist ODNR in evaluating experience or qualifications of the professional engineer.

1.4 APPLICABLE STANDARDS

A. Applicable standards for design and fabrication are the latest edition of the following:
1. American Institute of Steel Construction (AISC), Manual of Steel Construction.
2. American Welding Society (AWS) Structural Welding-Code Steel.
3. American Welding Society (AWS) Guide for the Nondestructive Inspection of Welds.
4. American Society of Testing Materials (ASTM)
5. The Aluminum Association, Inc. Design Standards.
6. American Wood Preservers Association (AWPA)
7. American Society of Civil Engineers, Manual 50 – Planning and Design for Small Craft Harbors, Revised Edition, 1994.
8. Americans With Disabilities Standards (ADA)
9. American Iron and Steel Institute, Light Gauge Cold, Formed Structural Steel Members Design Manual.
10. ICC Evaluation Service (ICC-ES), Report 2325

B. Any conflict between this Specification and the referenced standards shall be immediately brought to ODNR's attention for resolution.

1.5 SHOP DRAWINGS AND OTHER SUBMITTALS

A. Shop drawings showing complete fabrication details shall be submitted for approval before the production of docks begins. All drawings and calculations shall bear the seal of an Ohio Registered Professional Engineer experienced in the design of floating dock systems.

B. Three copies of design calculations signed and sealed by the Dockage Designer (or another Ohio Licensed Professional Engineer, experienced in floating dock design) with an affidavit stating that "the structural details, specified materials and performance of the system under design loadings are in complete conformance with the design criteria".

C. Three copies of shop drawings and manufacturers' literature, signed and sealed by the Dockage Designer (or another Licensed Professional Engineer, experienced in floating dock design) with an affidavit stating that "the structural details, specified materials and performance of the system under design loadings are in complete conformance with the design criteria". Shop drawings shall include all information necessary for the fabrication of component parts of the structure. All drawings shall be accurately and completely

dimensioned. Drawings shall indicate all relevant sizes and shall show thicknesses, gauges, finishes, materials, etc., of all items shown. Indicate size of members, type and location of shop and field connections and the type, size and extent of all welds. The following is a partial listing of details required for submittal:

1. Cover sheet listing project, location, Owner, Manufacture and all project design criteria.
2. Plan view layout(s) showing location of all joints, framing, cleat layout, anchoring system, and all other dockage amenities.
3. Typical sections at headwalk.
4. Section and elevation of gangways.
5. Details of anchoring system.
6. Details of flotation for each dock unit.
7. Side skirts, rub strips, and corner guards.
8. Technical product data for all major components.
9. Installation and removal instructions.
10. Layout and fabrication drawings for all structural units and gangways.
11. Detailed decking layout. For concrete paver decking, include panel layout for all floating docks.
12. Details of all connections between dock units and access structures.
13. Complete calculations showing adequacy of design.
14. Float buoyancy information covering floats to be used on this project, obtained by submergence testing and certified by an officer of the float manufacturing company.
15. Lifting frame for docks and gangways.
16. Listing of spare parts being furnished.

D. All drawings shall utilize standard A.W.S. symbols. Bolt diameter, lengths and strength shall be shown.

E. Three copies of a complete Operations Manual, as a minimum, containing the following information:

1. Manufacturer's representative's name, address and phone number.
2. Location of anchoring and connections to dockage.
3. Complete discussion of the system winterization.
4. Drawings, diagrams, installation instructions and parts lists.

F. Concrete decking panel sample, as applicable.

1.6 CALCULATIONS

A. Calculations shall be provided and stamped by the professional engineer on this project for a minimum of the following:

1. Flotation loads.
2. Freeboards.
3. Main dock and finger deflections.
4. Structural frame design for applied loads.
5. Adequacy of all weld design and bolt sizing and strengths.
6. Strength adequacy of connectors and pile guide attachments.
7. Dock section-lifting rings.
8. Anchoring design and attachments.

9. Gangway deflection loads along with handrail design.
10. Lifting frame.

1.7 QUALITY ASSURANCE

A. Copies of forms are to be provided by the dock manufacturer which shows that their QA program will be carried out. Submit prior to use and after completion.

B. Certifications for welders who will be doing welds in the QA program.

1.8 MAINTENANCE AND CLOSEOUT MANUAL

A. Before final acceptance of the floating dock system, the Contractor shall provide 3 final copies of a bound manual, which shall include:
1. Conformance of design letter by P.E.
2. Individual dock and gangway weights.
3. Calculations and certified float buoyancy listings.
4. Frame strength analysis and designs.
5. 11 x 17 “as built” drawings.
6. Specifications.
7. Maintenance recommendations.
8. Manufacturer’s data and cut sheets.
9. Completed quality control sheets.
10. Welders Certifications.
11. Winterization procedures for docks and utilities.
12. Written warranty.
13. Float test reports for encasement thickness and foam water absorption.

1.9 SERVICE LIFE

A. The minimum service life of the hardware, marina floats, floating breakwater, and mooring assembly is 25 years.

1.10 DESIGN CRITERIA

A. GENERAL DESIGN

1. The dock and attenuator layout shall be to the configuration shown on the drawings. Dock dimensions or dock square footage calculations shall be measured from edge to edge of the dock structural frame and do not include side skirts, bumpers or connections.

2. The dock manufacturer shall review with ODNR the proposed method of winterization to assure agreement with the anchoring system.

3. The docks are to be designed to remain within the lake and not removed during ice conditions. Therefore, all aspects of the dockage system shall be suitable in ice conditions. All equipment and supplies required for winterization shall be identified and provided by the Manufacturer.

4. Dock design provisions shall be verified by calculations performed by an Ohio Registered Professional Engineer experienced in floating dock design. These

calculations shall be approved by ODNR prior to dock fabrication.

5. Structural components shall be designed using yield stress not ultimate stress.

B. ENVIRONMENTAL CONDITIONS

1. Water Elevations:

a. The water level at project site is subject to Caesar Creek Lake water levels. Caesar Creek Lake is a USACE operated flood control reservoir and is subject to varying water levels in response to rainfall and snow melt events.

b. The dockage system, attenuator system, gangways and anchoring shall be designed for a normal range of winter low water of 845.25' NAVD88 (846.00' NGVD29) to the historic high water of 870.55' NAVD88 (871.30' NGVD29) and with all facilities under full design loadings listed below.

c. During the 100 year flood event, the dockage system, gangways and anchoring shall be designed for an extreme water level range of 845.25' NAVD88 to an ultimate elevation of 874.65' NAVD88 with full dead loads and 75% of the design live loads.

2. Environmental Loading:

a. All floating units and mooring system components shall be designed to withstand the forces and displacements from the 1 in 50 year return period environmental loads as given below.

b. Wind Generated Wave Loading:
   i. Significant Wave Height, H_s: 2.0 ft
   ii. Peak Period, T_p: 2.8 s
   iii. Design Wave Height, H_{design}: 3.6 ft

c. Boat Wake Generated Wave Loading (Continuous):
   i. Mono-Chromatic Wave Height: 1.5 ft
   ii. Peak Period, T_p: 2.4 s

d. Wind Loading (Hourly, By Direction):
   i. NE: 47.2 mph
   ii. E: 34.4 mph
   iii. SE: 39.1 mph
   iv. SW: 60.2 mph

e. Current Loading: 2 feet per second

f. Ice & Snow Loading:
   i. Snow load per OBC
   ii. Average Estimated Ice Thickness with Snow: 22.9 inches

C. PERFORMANCE REQUIREMENTS

1. The Manufacturer is responsible for verifying the stability and structural integrity of the docks due to any singular or realistic combination of loading conditions given herein.

2. Dead Load Design

a. Dead load is defined as the weight of the entire dock, access ramps, mooring system, appurtenances, and utilities including all electric, water, sewage, fire, cleats, etc. Pipes carrying liquids shall be assumed to be full when calculating dead load.

b. Dead load freeboard shall be 22" to 26". Design of freeboard shall be indicated in the shop drawings.

c. The Manufacturer shall list the freeboard of each dock unit on the submittal drawings. Actual dead load freeboard shall be no more than +/- 1 inch of the freeboard listed on the drawings with the following exceptions:

i. The outer ends of finger docks shall be either level with or may be up to 2 inches higher than the mainwalk where they attach. The outer ends of finger docks shall also have no more than a ½" drop across the end per 3' of width.

ii. The mainwalk dock under gangways may be up to 2 inches higher than the average mainwalk freeboard listed on the submittal drawings.

d. Mainwalks shall not slope lengthwise or crossways more than 1 inch in 10 feet.

e. For cantilever docks both ends shall be a maximum of +/- one inch from the average freeboard of the dock.

3. Vertical Live Load Design

a. For flotation calculations, all dock walking surfaces shall have adequate flotation under them to support all dead loads plus a minimum of 30 pounds per square foot live load.

b. The dock and supporting frame shall support a 400 lb concentrated load on any one square foot area.

c. Additional flotation shall be provided under docks at gangways so as to prevent loss of freeboard (defined as 25 percent of total freeboard) under the bottom of the gangway under normal loading conditions.

d. In addition to the above, when a 400 pound load is applied in the center of a finger dock or a cantilever dock, 2 foot from the outer end, there shall be no

more than 4 inches loss of freeboard at the end of the dock.

e. If docks cantilever off of the shore, there shall be no more than 4 inches of loss of freeboard when a 400 pound load is applied to the junction of the gangway and the first dock section.

f. When a 200 pound load is applied to one outer corner of a finger or a cantilever dock, there shall be no more than 2 inches of difference in freeboard across the end of a 3 foot wide finger, and proportionally more on wider fingers.

g. The free board on the overall dock system shall not vary more than 1 inch from the approved drawings. On the main headwalk the slope shall not vary more than 1 inch in 10 feet. At the design load of dead load plus 30 psf live load, a free board of not less than 12 inches shall be maintained. Flotation shall be adequate to ensure that the piers shall maintain a uniform free board over the length of the pier.

h. In calm conditions, the deck shall sit level with a maximum cross slope of 2% and maximum longitudinal slope of 1.6%, under the influence of live load and point loads, and less than 10 inch (250 mm) deviation between highest and lowest deck elevations throughout the system of floats.

i. Structural members and deck surfaces shall be designed with a uniform live load of 50 PSF. Maximum deflection under live and dead loading shall be L/240.

j. During wave action, the vertical angular deflection between any two adjoining float modules should not exceed 2 degrees.

4. Horizontal Live Load Design

a. Wind Loads

i. Wind loads shall be 15 pounds per square foot (77 miles per hour) approaching from any direction. Loads shall be calculated perpendicular to diagonally opposite corners of the pier, perpendicular to the mainwalk and perpendicular to dock fingers.

ii. Wind loads shall be applied to the pier continuously without any deductions for walkways, fingers or open areas between boats.

iii. Wind loads shall be applied to a vertical plane from the water surface up to the average high profile of all boats expected to use dock. Typical profiles for boats are as follows:

Finger and/or Maximum Boat Length	Boat Profile Heights
16’	7’
20’	7’
24’	7’
28’	7.5’
30’	8’
32’	8’
36’	8.5’
40’	9’

iv. Uniform wind load parallel to the headwalk; assume to be full wind on unshielded boats (15 psf) and 20% of full wind on all shielded boats. Wind load perpendicular to the headwalk, assume to be full wind on the unshielded side of the headwalk (15 psf) and 15% of full wind on the shielded headwalk side.

v. Maximum lateral and longitudinal wind pressure on a fully occupied marina shall be determined using 30-second gust wind speeds by appropriate direction. Full wind load parallel to the headwalk shall be applied to unshielded boats and 20% of full wind on all shielded boats. Full wind load perpendicular to the headwalk shall be applied to unshielded side of the headwalk and 15% of full wind on the shielded headwalk side.

b. Wave Loads

i. Docks and anchoring system shall be designed for Continuous Boat Wake Waves for the entire service life with no fatigue failures.
ii. Docks and anchoring system shall be designed for the Wind Generated Significant Wave (H_s) for a duration of ten hours.
iii. The assembled Docks and Anchoring System shall be designed to withstand the maximum design wave height for 1% of the time considering the effects of buckling, flexing, compression, and torsion.

c. Combined Loads

i. Anchoring design shall be adequate to withstand wind, wave, ice and currents at all water levels and shall be applied cumulatively.

d. Displacement

i. Maximum allowable horizontal displacement of a mooring line restrained marina dockage system due to the total applied loading conditions for any mooring line constrained dockage shall be no more than +/- 2 feet in any direction and the system shall work in conjunction with the main landside connection gangway system.
ii. Maximum allowable horizontal displacement of a mooring line restrained attenuator, without public access, due to the total applied loading conditions for any mooring line constrained attenuator shall be no more

than +/- 5 feet in the transverse direction and +/- 2 feet in the longitudinal direction

iii. Maximum allowable horizontal displacement for the base-bid mooring line restrained attenuator, due to the total applied loading conditions for any mooring line constrained attenuator shall be no more than +/- 5 feet in the transverse direction and +/- 5 feet in the longitudinal direction.

iv. Maximum allowable horizontal displacement for the alternate-bid mooring line restrained attenuator with public access and gangway system, due to the total applied loading conditions for any mooring line constrained attenuator shall be no more than +/- 2 feet in the transverse direction and +/- 2 feet in the longitudinal direction and the system shall work in conjunction with the public access gangway system.

e. Ice Loads

i. The structures, floats and anchoring system shall be designed to withstand the forces of ice without damage. The dockage system will not be removed during the winter months. “Winterization Procedures" for moving ice shall be provided in the winterization manual furnished by the Manufacturer.

f. Impact Loads

i. All main walkay docks, finger docks and connections shall be designed to resist the impact of a boat, the length of the finger, striking the edge of the finger dock, at the outer end, at a maximum angle of 10 degrees to the dock centerline at a velocity of 3 feet per second for 1 second deceleration. Boat weights for various boat lengths shall be assumed as follows:

16 to 20 foot 4,000 pounds
24 foot 8,000 pounds
28 foot 13,000 pounds
30 foot 16,000 pounds
32 foot 18,000 pounds
36 foot 26,000 pounds
40 foot 34,000 pounds

g. Wave Attenuation

i. The attenuator shall be designed to allow a transmitted wave, considering the angle of approach, of maximum of 0.5 ft, monochromatic, for a 2.4 second boat wake.

ii. The attenuator shall be designed to allow a transmitted wave, considering the angle of approach, of maximum of 0.8 ft, significant, for a 2.8 second storm wave period. The transmission shall be based on the fully assembled attenuator system considering any openings and connection clearances.

iii. The range of water level excursion is defined in 1.10(B). Attenuation characteristics shall be computed for both high and low water cases.

iv. Demonstration of expected transmission performance shall be based on actual field measurements of wave transmission at similar wave periods

and water depths, or laboratory data of similar conditions, or as predicted from the following computed for normal wave incidence, or similar:

$$C_t = C_b K_t$$

where:
$C_b = [2\sqrt{(1+(2\pi B/L)^2)}]/[2+(2\pi B/L)^2]$,
$K_t = 2P/(1+P)$ and
$P = [4\pi (d-D)/L + \sinh 4\pi (d-D)/L]/ [4\pi d/L + \sinh 4\pi (d)/L]$,
with B = breadth of float, D = draft of float, d the water depth, and L the local wavelength.

v. The vendor shall provide further calculation or calibrating data indicating the accommodation needed to estimate the true transmission expected because of oblique wave incidence, necessary porosity of the attenuator assembly, attenuator motions and end diffraction effects.

vi. The system shall be constructed of either concrete or structural steel based framing system. Connection of adjacent unit shall not be hinged and shall be capable of transferring design bending stresses in both horizontal and vertical planes.

vii. When assembled as an attenuation system, the attenuator modules shall be connected such that the system behaves as a continuous beam with a minimum stiffness (EI) of 900,000,000 lb-in2 per foot of dock width.

D. GANGWAY PERFORMANCE REQUIREMENTS

1. Gangways are access structures with handrails and shall be designed to support a full live load of 50 pounds per square foot.

2. Gangway handrails shall be designed for a 250 pound load applied in any direction and at any point along the handrail. Railing shall also be designed for 50 pounds per linear foot applied to the top rail.

3. Gangway substructure shall have sufficient strength to resist all live and dead loads listed without excessive deformation. Substructure shall be designed to support full live and dead loads for the length of the gangway span with a maximum deflection of L/240.

E. CONNECTIONS

1. Each dock frame unit shall be connected to each adjacent dock frame unit with a connection capable of transmitting all loads and forces upon each dock frame unit and each series of dock frame units, including the combined transverse and longitudinal effects of wind action, wave action, and bumping and ramming by average pleasure craft. Connections shall be designed for disconnection for maintenance without the removal of plates or structural members. Disconnection

shall not require the removal of any bolts underwater. Connection bolts and hardware shall be galvanized or stainless steel with vibration resistant nuts/washers/locknuts.

F. DOCK ANCHORING

1. The floating docks and attenuator shall be designed to be held in position using mooring lines as designed by the Manufacturer. Frequency of spacing and sizing of components of the anchoring system shall be as required to satisfy the horizontal loading requirements and the structural integrity of the floating dockage system. The system shall function at all expected water levels up to the 100-yr water elevation. The system shall also prevent torsion, racking and twisting by providing sufficient built-in torsion resistance.

2. Mooring system shall be laid out and designed for future marina expansion as shown on the drawings and to allow for proper clearances of boats through all expected water levels.

3. No portion of the dock system, including building float platform, shall extend greater than 3-feet below the water surface.

4. Provide a chafe guard of mooring line/tube locations and where mooring lines cross.

5. Driven piles for the gangway and gangway platforms shall have a top minimum elevation of 876.0 feet. Piles shall have black pointed caps installed with set screws to prevent the caps from coming off.

6. All dock anchoring components shall be detailed on the shop drawings, along with any calculations necessary to show these components have adequate strength to withstand the loading conditions listed in these specifications.

1.11 ACCEPTANCE

A. Acceptance of the floating dock system shall be a date agreed upon by the Contractor/Dock manufacturer and ODNR. This date shall be after completion of all punch list items, a final inspection covering the floating dock system and receipt of a manual covering all design items as required.

1.12 EXTENDED WRITTEN WARRANTY

A. The Dock Manufacturer shall be responsible for approving the dock installation and shall furnish ODNR with a manufacturer's extended written warranty covering repair of any defects or damages which may develop within five (5) years from date of completion and acceptance of work performed under this contract, provided said defects or damages, in the judgment of ODNR, are caused by inadequate design of the floating dock systems for the conditions as specified or can be responsibly expected and providing ODNR operates the facility in accordance with acceptable procedures. If the defects and/or damages are not repairable, the defective or damaged portion shall be replaced to its original condition by the Manufacturer without expense to

the Owner. This warranty covers all labor, material and shipping and handling costs used in the construction and installation of the docks, but excludes deterioration due to the normal aging and weathering process of the wood and metal parts. The guarantee for the flotation materials shall be for a period of ten (10) years.

1.13 PAYMENT

A. See Section 01150 Measurement and Payment.

PART 2 - MATERIALS

2.1 CONSTRUCTION

A. All joints and connections between floating structures must be capable of transmitting all loads and forces imposed upon the structures. Connections shall not protrude above the level of the deck or beyond the side of the skirt.

B. Structures are to be factory assembled in the largest possible shippable units. Modular structures must be designed for quick and easy assembly and disassembly with a minimum of bolts and connectors.

2.2 STRUCTURAL STEEL

A. All steel members of the structural frame shall be ASTM A-36 or stronger, with minimum material thickness of 3/16" for hot-rolled or cold-formed shapes. All angles in the structural frame shall be a minimum of 2” x 2”, except in side and cross joist webs.

B. All steel members shall be zinc coated (hot dip) galvanized after fabrication in accordance with ASTM A-123. All bolt holes, slots, etc. shall be drilled prior to galvanizing. Welding after galvanizing shall not be permitted. Minimum zinc coating properties required are as follows:

Product Form	Minimum Weight (oz./Sq. ft.)	Minimum Thickness (mils.)
0.125 inch, 0.1875 inch Steel	2.0	3.0
0.25 inch and thicker	2.0	3.4

C. Minimal field cutting, welding or drilling will be allowed, if pre-approved by ODNR. Steel surfaces exposed by cutting, welding or drilling shall be coated with a zinc rich cold galvanizing paint.

2.3 STRUCTURAL ALUMINUM

A. All aluminum members shall be ASTM 6061 T-6 or equal, with minimum material thickness of 5/16 inch.

B. If the Contractor proposes to use a dock system with a section thickness of less than 5/16 of an inch, the Dock Manufacturer shall provide a 10-year written warranty to ODNR and the Dock Manufacturer shall provide yearly inspections of the dock system during the written warranty period.

2.4 DECKING ON DOCKS

A. General

1. Decking material on docks shall be suitable for a marine environment and provide a non-slip walking surface.
2. Decking on the fuel pier shall be concrete pavers.
3. Base Bid decking shall be either Ipe or Composite. Transformer Pads, Fillets, and fire protection staging areas shall be similar to main dock decking material.
4. Transformer Pads, Fillets, and fire protection staging areas shall be the same main dock decking material and manufacturer unless the Concrete Paver Alternative Bid Decking material is chosen.
5. Alternative Bid(s)
   - i Composite Decking: Transformer Pads, Fillets, and fire protection staging areas shall be the same material and manufacturer as installed on the main dock decking material. All material to be from a single manufacturer.
   - ii Concrete Decking: Transformer Pads, Fillets, and fire protection staging areas shall be composite decking if concrete pavers are chosen to be installed as the main dock decking material.

B. Composite decking: Wood-plastic composite product intended for decking in a marine environment. Anti-skid surface.

1. Manufacturers/Products:

   - i. TimberTech DockSider® as manufactured by Crane Plastics, Columbus, OH, phone 614-443-4891. Color to be gray. All members shall be capable of spanning 24-inches on-center.
   - ii. Moistureshield Vantage® Composite Decking as manufactured by Advanced Environmental Recycling Technologies, Cape Cod Grey. All members shall be capable of spanning 24-inches on-center.
   - iii. Geolam Composite Decking, Qualita or Bounty for decking material. Sideskirts shall be Bounty. Color to be Ebony. All members shall be capable of spanning 24-inches on-center.
   - iv. Or equivalent as approved by ODNR.

C. Ipe hardwood: premium select grade hardwood decking. Material shall be free of splits, checks, bark, wane, cupping, knots, discoloration, and surface imperfections whether aesthetic, or functional in nature.

D. Concrete pavers: Solid paving units made from Portland cement and lightweight aggregate concrete with a compressive strength not less than 4,500 psi, water absorption not more than 5 percent according to ASTM C 140. No breakage and not more than 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67. Pavers shall have a combination of welded wire steel grid and polypropylene fiber for reinforcement. Non-slip surface. Manufacturers: Elite Precast, or approved equivalent by ODNR. Thickness: 1-5/8”. Color/finish: Slate Rock. Nominal size: 2’x2’ square, standard, with nominal 1’ x 2’ and 1.5’ x 2’ units to be used when odd dimensions are required. Cutting of Concrete panels is forbidden.

2.5 SIDE SKIRTS

A. Side skirts shall be installed on all exterior dock frames.
   1. Side skirt boards for docks with Ipe hardwood decking shall be 1x8 Ipe hardwood planks premium select grade, of constant thickness.
   2. Skirt boards for all docks with the alternative bids for concrete pavers, or alternative bids for composite decking, shall be Timbertech DockSider®, Moistureshield Vantage® , or Geolam Bounty® to match the decking material and manufacturer, 1.25-inches thickness (minimum) composite material or equal as approved by ODNR. For the Base bid, the fuel pier (concrete decking required) shall also have Ipe hardwood plank side skirts to match the main docks.

2.6 RUB STRIPS AND CORNER GUARDS

A. Non-marring vinyl, PVC or resilient rubber. Color shall be UV stabilized black. Material shall be tough and tear-resistant and maintain flexibility to a temperature of 10 degrees Fahrenheit.

B. Rub strip manufacturer: Edge pro 5002, as manufactured by Dimex Corp., Marietta, OH, phone 800-334-3776, or equal.

C. Continuous rub strips shall be installed around all docks, unless otherwise shown on drawings.

D. Outside corners shall be protected by molded corner guards and not by mitering or bending extruded rub strips.

E. Corner guard manufacturers:

   1. Dock Boxes Unlimited, Inc. (www.dockboxes.com), Dock Corner Bumper Model UC30600B.
   2. K&R Manufacturing Company, Camdenton, MA (www.krmfg.com), Model CB I.
   3. Floating Docks Mfg, Co., Indianapolis, IN. Corner Bumper Size 10”.
   4. Other approved equal.

2.7 CONNECTIONS

A. Rigid: Fastening of metal structural members to each other shall be a combination of bolts and welds. Bolted connections shall conform to standard AISC specifications with lock washers or lock nuts or other ODNR approved methods. Welds shall be executed in accordance with the provisions of the American Welding Society specifications. All fasteners and welds shall be provided with adequate coating thickness so that the fasteners will not show rust during the warranty period.

B. Flexible: Flexible connections shall be capable of transmitting all loads and forces upon each dock unit and each series of dock units, including the combined transverse and longitudinal effects of wind action, wave action, and bumping and ramming by average pleasure craft. Connections shall be designed for ready disconnection for

periodic maintenance without the removal of plates or structural members. Disconnection shall not require the removal of any bolts underwater.

2.8 HARDWARE

A. Bolts, lag bolts, screws, flat washers, lock washers and any other fasteners used by the manufacturer shall be of the type and size best suited for the intended use. All fasteners shall be stainless steel or have adequate coating thickness so that the fasteners will not show rust during the service life of the dockage. Aluminum truss systems shall use Type 304 stainless steel connectors and shall isolate incompatible metals to mitigate electrolytic action.

B. Nails or staples will not be permitted.

2.9 FLOTATION

A. Flotation material shall be expanded-in-place closed cell polystyrene, with a minimum density of 0.9 pounds per cubic foot and water absorption less than 3.0 pounds per cubic foot when tested by “The Seven Day Hunt Absorption Test”. Any and all test samples shall meet this requirement.

B. Encasements shall be fully foamed inside on all six surfaces with no voids, air gaps or loose beads.

C. Flotation encasement shall be rotomolded high, medium or linear low density polyethylene appropriate for marina environment, black in color, with no regrind material, totally watertight and with the following properties:

1. Nominal Thickness: 0.150”
2. Minimum thickness: 0.125” (unless listed otherwise on drawings).
3. Minimum density: 0.939 grams per cubic centimeter.
4. Minimum ultimate tensile strength: 2600 pounds per square inch (ASTM D-638).
5. Minimum flexural modulus: 97,000 pounds per square inch (ASTM D- 790).
6. Minimum 2% carbon black and UV stabilized.

D. Minimum thickness of the encasement shall be tested and confirmed in a test report, using a micrometer or a go-no-go gauge, on each float tested for absorption. ODNR reserves the right to test the flotation units at the job site.

E. Flotation units shall be manufactured in a fashion to allow full bearing of the float on the structural frame in both vertical and lateral directions. Lateral support by bolted connections only, through the encasement, will not be accepted.

2.10 DOCK CLEATS

A. Dock cleats shall be galvanized heavy duty cast iron as manufactured by Peerless (or approved equivalent). Quantity and location shall be as shown on the drawings. All cleats shall be 10-inch heavy duty.

B. Mounting bolts shall be A-325 minimum strength. Bolts shall be recessed to prevent bolt heads from chafing lines.

C. Cleats shall be straight (not S-type).

D. Alternative cleat attachment shall be provided for concrete decking which allows the Peerless heavy duty cast iron cleats to be mounted on the top of the dock structure in a similar fashion to standard decking. Cleat shall be mounted in such a manner that the cleat does not overhang the side skirt creating hazards to moored boats.

E. To be provided by the Manufacturer.

2.11 LIFTING RINGS

A. Each dock and gangway shall have installed 4 lifting rings, 2 along each side at the quarter points. Rings shall be galvanized and capable of carrying ¼ of each dock's dead weight and the rings shall lay down when not in use.

2.12 DOCK ANCHORING

A. Dock and attenuator anchoring type shall be determined by the manufacturer and may be a combination of any of the following:
Elastic anchoring system
Chain and anchor anchoring system

B. If the dock and attenuator anchoring system designed by the manufacturer is comprised of an elastic anchoring line, system shall be capable of the design parameters listed. A combination thimble and shackle shall be integrated into the system to provide the necessary connection between the hawser and square plait polyester rope. A bypass rope shall be combined with the rubber hawser elongation of 80%

C. Anchoring system anchors shall be designed and supplied by the Contractor and may be reinforced concrete, driven anchor pile (cut off at lake bed), helical anchor, or other ODNR approved anchoring method.

D. Main Access Floating Platform and gangway anchoring shall be driven pile as shown. All materials utilized shall be similar to those in the dockage and attenuator construction and shall be approved by ODNR prior to fabrication.

2.13 GANGWAYS

A. Gangways shall be constructed of aluminum and fabricated with a camber such that there is no negative deflection (sag) under dead load.

B. Gangways designated as ADA shall meet ADA all guidelines for transition plates, guarding, handrail extensions, rail heights and diameters and mid and toe rail locations.

C. Decking on aluminum gangways shall be extruded aluminum with an anti-skid surface.

D. Design and fabrication of the connection of the gangway to the bulkhead wall, central floating platform and docks is the responsibility of the floating dockage manufacturer.

E. Gangways shall have railings on both sides with a top rail at 42 inches and a mid- rail at approximately 21 inches. For ADA gangways an additional handrail and a toe-rail shall

also be provided per ADA requirements.

F. Ends of top handrails shall run the full length of the gangway horizontally and then curve downward to the base of the gangway extending past the ends of the gangway a minimum of 1 foot. Ends shall be curved or mitered. Handrails shall be smooth with no open joints, burrs, etc. which would cause possible cuts on a person's hand.

G. No structural framing shall be allowed to protrude outside of the gangway pickets.

H. Gangway transition plates on ADA accessible Gangways shall meet ADA guidelines w/ ADA compliant Handrails as required. Transition plates on gangways shall have ADA compliant handrails for the entire length. Aluminum or stainless steel wear plates shall be provided where all gangway transition plates come into contact with dock surface. Plates shall be sized to accommodate full excursion of floating dock system.

I. Gangway shall have exterior guarding in conformance with the Ohio Building Code in the form of exterior pickets with a center to center spacing not to exceed 4 inches.

2.14 SAFETY LADDERS

A. Safety ladders shall be constructed of stainless steel, marine-grade aluminum or alternative durable and corrosion-resistant materials as approved by the Engineer. Ladder shall be collapsible with interlocking rungs that extend when the ladder is in use, with a minimum of four rungs. Ladder shall be manufactured by Up-N-Out® Marine Ladders, Scandia Marine Products, Forest Lake, MN (www.up-n-out.com) or approved equal.

B. Contractor shall provide details of ladder attachment to docks.

PART 3 - EXECUTION

3.1 GENERAL

A. All floating docks and gangways shall be fabricated, from approved shop drawings, in the dock manufacturer's plant and be complete, with flotation, so that they can be lifted off the truck directly into the designated storage area on the project site.

B. Field fabrication of individual components will not be allowed, with the exception of connecting assembled units together or placement of the anchoring system(s).

C. The dock manufacturer shall provide an experienced field representative to supervise unloading and installation of the floating docks, gangways and all associated equipment.

D. Installation of decking and dock appurtenances shall be in accordance with the manufacturer's installation standards and guidelines.

3.2 WORKMANSHIP

A. Docks shall be completely prefabricated by the dock manufacturer and delivered ready for direct unloading into the water. All workmanship shall be first class in all respects and any work not representing a finished and acceptable appearance will be rejected.

B. All finished steel or aluminum members shall be free from corrosion, twists, bends,

distortions and open joints. All steel or aluminum construction shall be free of sharp edges and burrs. Ends of exposed steel members shall be rounded or beveled. All coping and mitering shall be done with care. Projecting materials and burrs that would prevent bearing of the various members on each other shall be removed.

C. All drilling and cutting of steel done after galvanizing (if approved by ODNR) shall be painted with a zinc dust content paint. All welds over galvanized material shall be thoroughly cleaned and coated with two coats of cold galvanizing compound.

D. All bolts, nuts and washers shall be set square with connecting structural members and the nuts shall be drawn up tight. Lock washers or other devices or techniques shall be used to prevent nuts from loosening when subjected to all specified loading conditions after being properly tightened.

E. All welding shall conform to the requirements of the AWS. Welds shall be a solid and homogeneous part of the metals joined and shall be free from pits or scale, and shall be of full areas and length required to develop the required strength for the intended use.

F. All bolts, nuts and washers shall be set square with connecting structural members and the nuts shall be drawn up tight. Lock washers or other devices or techniques shall be used to prevent nuts from loosening after being properly tightened.

G. Edges of all exposed wood members shall be slightly beveled to ease sharp corners and preclude wood splinters from forming.

H. All decking shall be free of extra holes, broken screws, and misaligned screw drive lines.

3.3 DOCK SUBSTRUCTURE

A. Individual dock units shall be made up of steel or aluminum welded together to make a structural frame. The structure shall carry all design loads (as per Part 1.10 of this specification). Decking and flotation shall not contribute to structural strength calculations.

B. Modifications to structural frame for anchoring system, attachments, etc. shall be factory fabricated prior to dock assembly and galvanized.

C. When two dock units 3’ and/or 4’ are assembled side by side, they shall be bolted or welded on both top and bottom stringer with attachments at maximum of 2’ intervals.

D. All structural steel frames shall be hot-dip galvanized as per Section 2.2 B after being completely assembled and all welds, drilled holes, etc. are performed.

E. A suitable lifting frame shall be supplied and shipped first or with the first shipment of docks delivered to the site and shall remain the property of ODNR. Lifting frames shall be designed to provide vertical lifts for all dock and approach structures and shall include a complete set of chains with snap hooks. Design shall be coordinated to work with the proposed lifting equipment.

F. Manufacturer shall use the lifting frame to unload the dock sections and to place the docks into the designated storage area. Contractor shall use the provided lifting frame to lift the docks into the water for installation.

3.4 FLOTATION

A. Individual flotation units shall be attached directly to the structural frame, using a minimum 3/8" bolt, washer, lock washer and nut which have a life expectancy as long as the flotation unit itself. Fasteners are not permitted to penetrate float encasements under any circumstances. Attachment shall be in all four corners and on maximum of 2' intervals on sides and end.

B. Both sides and ends of float shall be supported by the dock frame. Minimum frame support of float drum must be every 48" by 48" or 16 square feet.

C. Individual flotation units shall be attached directly to the structural frame, using a bolt, washer, lock washer and nut which have a life expectancy as long as the flotation unit itself. Fasteners are not permitted to penetrate float encasements under any circumstances. Attachment shall be in all four corners and on all accessible factory holes on sides and end.

D. Flotation shall be designed and protected so that no damage occurs during shipping, handling, or under normal use. Docks which arrive on the job site with damaged flotation units shall have floats replaced at no cost to ODNR.

E. The Manufacturer or float manufacturer shall supply a sample flotation unit to ODNR or their consultant or an ODNR approved testing lab for destructive testing prior to dock manufacture. If the sample unit does not comply with Section 2.09, then two additional sample floats shall be furnished and must comply. ODNR also reserves the right to destructively test 1 out of every 100 or less floats at the jobsite.

F. If a float does not meet ODNR specifications then two more floats of the same size shall be tested. A single non-conforming float may be replaced; however, if three or more floats are non-conforming then all dock floats shall be rejected and replaced. Floats used in destructive testing shall be replaced by contractor at no additional cost to ODNR.

G. As an alternate to E & F, the consultant and ODNR may accept certification of compliance by the float manufacturer showing testing compliance on same size floats on other projects during the past 12 months from when this project was awarded. The right for field testing still exists.

3.5 DECKING ON DOCKS

A. For Ipe hardwood or composite decking, deck boards shall be attached to structural supports with fasteners at a maximum of 2 foot centers, 2 fasteners at intermediate supports and 3 fasteners at deck board ends. Deck screws shall be hot dip galvanized to ASTM A-153 or stainless steel. They shall be pre-drilled and countersunk, set flush with the upper surface of the decking so as to not splinter, split the board or enable water to pond in screw head. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced. A chalk line shall be used to align all screw heads along entire head pier and finger piers. All chalk (alignment) lines shall be removed prior to acceptance. Ends of boards shall be aligned with no variation in length from one board to the next.

B. Composite Decking:

1. Anti- skid surface shall be placed facing up. All planks shall be laid crosswise with a gap of ¼" between planks. Ends of planks shall be ¼" away from side skirt and frame edge. Planks shall be supported on structural supports spaced as recommended, in writing, by the manufacturer of the decking.

2. Attachment shall be made at all supports with stainless steel screw fasteners. Fastener spacing from ends and sides of boards shall be as recommended by composite decking supplier. They shall be pre-drilled and countersunk, set flush with the upper surface of the decking so as to not mushroom the surface, split the board or enable water to pond in screw head. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced. A chalk line shall be used to align all screw heads along entire head pier and finger piers. All chalk (alignment) lines shall be removed prior to acceptance. Ends of boards shall be aligned with no variation in length from one board to the next. All details of deck fastening shall be as shown in the suppliers published installation instructions. Dock and deck use shall be considered commercial.

3. Cutting of composite decking shall be done with carbide-tipped saw blades to maintain clean-cut edges.

4. Composite decking shall not be sanded or otherwise altered unless expressly allowed by the ODNR.

C. Concrete Paver Decking:

1. Layout shall be per Manufacturer's design and approved shop drawing. Field cutting of concrete pavers is prohibited.

2. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

3. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

4. Tolerances: Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.

5. Concrete Paver shall be flush to adjacent utility plates, corner fillets, side skirts, transformer platforms and fire protection staging areas.

6. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

7. Pavers shall be set level and true and without a lip between adjoining pavers.

8. Panels shall be installed on spacers and shall be shimmed as necessary to eliminate rocking of deck panels. Panels shall not be permanently secured to the frame to allow for removal and replacement.

9. Pavers shall be set on the dock structure with a non-slip material such as tape or strip caulking to prevent pavers from sliding or slipping out of place. Spacing between pavers shall be not exceed 1/8" and shall be a constant dimension between all pavers. For odd-dimension finger pier widths, use additional supports to create a foundation for pavers, and use 1'x2' or 1.5'x2' pavers on the finger pier.

10. All materials required for installation of concrete pavers shall be supplied by the Dockage Manufacturer such as strip caulking, tapes and shims.

11. Locations on the dockage requiring penetrations for utilities and attachment of appurtenances such as dock utility centers, dry hydrants, fire cabinets, and life rings shall have aluminum diamond plate secured to the dockage frame as attachment points and shall be supplied by the Manufacturer

3.6 SIDE SKIRTS

A. Side skirts to be installed in locations as shown on the drawings. Board dimensions shall be sufficient to cover dock structure with 1/8" spacing between side skirt boards.

B. Side skirts shall be single planks in runs up to 20 foot. Lengths over 20 feet shall be made up of multiple long lengths with minimum 8 foot lengths, where possible. Joints shall fall a minimum of 2 feet away from structural frame joints.

C. Attachment shall be with three fasteners (top, center and bottom of each board) in a straight vertical line to the vertical side truss members of the pier frame, on maximum 4-foot centers. Fastener spacing from ends and sides of boards shall be as recommended by decking supplier. They shall be pre-drilled and countersunk, set flush with the surface of the side skirt so as to not splinter, split, or mushroom split the board. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced.

D. Side skirts shall be aligned so the top of the skirt board is flush with the top of decking. Miter inside corners.

E. Side skirts shall be set plumb and true to the dock frame. Shimming, grooving/dadoing of the boards may be required to properly align boards to deck and dock frame.

3.7 SIGNAGE

A. Dock signage shall be supplied and installed per Section 10440.

B. The Manufacturer shall supply safety signage on gangways as follows. Place sign between top and middle rail of access gangway at gangway entrance. Include the following on signs:
   1. Slippery When Wet
   2. Weight Capacity – 10 Persons (as appropriate)
   3. ADA Accessible (on ADA gangways)

3.8 CONNECTIONS

A. Connections between docks and shoreline abutments or dock abutments (where required) shall be made flexible as indicated on the detailed drawings and approved shop drawings. Connections shall be made by double shear connectors at the outer edges of dock or gangway units with a maximum opening of 1½ inches. For ADA docks maximum opening shall be 1/2 inch between units. For wider openings a transition plate is required.

B. Structural parts of connectors shall be of the same base metal as the dock's structural frame. Bolts, nuts & lock washers shall be stainless or galvanized steel.

C. Connections shall not protrude above the level of the deck and shall present a relatively smooth top surface with no sharp edges, or upward projections. Connections may have sufficient "play" to permit them to work freely, but such "play" shall be controlled to prevent no more than ½ inch transverse movement. The maximum difference between the bolt diameter and hole diameter shall be 1/16 inch.

D. When required, gangway to shore connectors shall be fabricated and then hot-dip galvanized prior to shipping. Manufacturer shall supply shore connectors (example: connectors to be cast into concrete abutments by the Dock Installation Contractor).

E. Design of special connections (i.e. cover plates, etc.) shall be approved by ODNR prior to manufacture of the dock(s).

F. Where there are wheels at the dock end of a gangway, there shall be no more than a 6 inch drop to the deck. A transition plate, properly reinforced, shall be placed at the end of the gangway. The wear edge shall be rounded for easy sliding on the deck. For ADA docks and gangways, the slope of the transition plate shall be no greater than 5%. The dock section under the gangway wheels shall have protective metal plates under the wheels and at the end of the transition plate.

G. Bolting of aluminum connections into concrete or steel shall be with stainless steel bolts, nuts and washers.

H. When aluminum connectors attach to galvanized steel, the aluminum shall be isolated with a neutral material such as plastic or rubber.

3.9 DOCK ACCESSORIES

A. Dock cleats shall be bolted directly into the dock structural framework. Alternate cleat configuration shall be used for concrete decking using the Peerless cleat. Bolts shall be galvanized or stainless steel. Cleats shall be provided where shown on the drawing and shall be factory installed to the greatest extent possible.

B. Bumpers/rub strips shall be attached to dock side skirts with stainless steel button head fasteners at 4 inch maximum centers in a neat and repeated pattern on both top and bottom flanges.

C. Hinged transition plates between dock units shall rotate freely thru the full range of rotation required. They shall be of galvanized steel or aluminum checker plate.

3.10 SPARE PARTS

A. Furnish the following spare parts:

1. One thousand (1000) deck screws.
2. Sixteen (16) cleats with bolts, nuts and washers.
3. Two hundred (200) feet of rub strip.
4. Twenty (20) corner guards.
5. Eight hundred (800) rub strip screws.
6. Sixty (60) dock connector pins or bolts, nuts, washer, etc.
7. Forty (40) 8-foot lengths of composite or ipe decking for docks.
8. Forty (40) 8-foot lengths of composite or ipe side skirt material for main.
9. Sixty (60) concrete paver units of each size used.

3.11 CLEANING

A. All debris shall be removed from the site prior to final acceptance.

END OF SECTION

SECTION 02500

AGGREGATE BASE COURSE AND SHOULDERS

PART ONE - GENERAL

1.01 SUMMARY

A. Section Includes: Aggregate Base Course on a prepared subgrade.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials, as referenced herein as AASHTO.

B. American Society for Testing and Materials, as referenced herein as ASTM.

C. Ohio Department of Transportation Construction and Material Specifications, latest edition, as referred herein as ODOT.

1.03 SUBMITTALS

A. Certification of aggregate conformance to specification.

B. Field Test Reports: During Construction, submit field test reports in accordance with the testing schedule specified herein.

1.04 QUALITY ASSURANCE

A. Testing and Inspection Service

1. The Contractor shall engage a Testing Agency to perform sampling and testing of aggregate materials proposed for use in the work, and field testing for quality control during construction operations.

B. Laboratory Tests

1. The Testing Agency will conduct sieve analysis of aggregate base course in accordance with ASTM C136 for each source.

C. Field Control Tests

1. Perform Field Density-in-Place Tests for each 5,000 square feet and each compacted layer of aggregate base course. Tests shall be in accordance with ASTM D1556, ASTM D2922 or other ASTM Test as determined by the Testing Agency.

2. When, in the judgment of the ODNR Project Manager or RPR, there is reasonable doubt about material characteristic of aggregate base course used in field, a field-conducted one point Proctor test will be conducted. If the moisture-density coordinates of the one point Procter test

do not fall on the curve which has been established by laboratory tests, a sample of that material will be tested in the laboratory for conformance to the specifications.

3. One copy of each report will be submitted to the Contractor. Reports will designate the location of the Work tested and document conformance or non-conformance to specification requirements. The report shall state recommendations for remediation of non-conformances. The Contractor shall comply with such recommendations.

4. Tolerances

   a. Flatness: maximum variation of 1/4 inch measured with 10-foot straight edge.

   b. Compacted thickness: within 1/4 inch.

   c. Variation from true elevation: within 1/2 inch.

PART TWO - PRODUCT

2.01 MATERIALS

A. Base Course Aggregate

1. Crushed gravel, crushed stone, complying with the grading and physical requirements of the ODOT Article 703.17.

PART THREE - EXECUTION

3.01 CONSTRUCTION OF AGGREGATE BASE COURSE

A. Subgrade

1. Confirm subgrade requirements of Section 02220 3.07 Compaction Requirements have been met.

2. Before placing base course, examine subgrade surfaces and verify that subgrade has been inspected, gradients and elevations are correct and subgrade surface is dry.

3. Smooth and trim unsuitable subgrade to required line, grade and cross section to receive the base course.

B. Aggregate Placement

1. Spread aggregate base course over prepared subgrade. Do not place aggregate over frozen subgrade or if there is indication that aggregate may become frozen before compaction is completed.

2. Place aggregate in layers of approximate equal thickness not to exceed 6 inches. Compact as specified. Provide total thickness after compaction as indicated on Contract Drawings.

3. Level and contour surfaces to elevation and gradients indicated.

4. Compact placed aggregate materials by appropriate equipment to achieve compaction of 95 percent of its maximum density as determined by ASTM D1557. Use mechanical vibrating tamping in areas inaccessible to compaction equipment.

5. Add water to assist compaction only when necessary to increase the performance of moisture or, if excess water is apparent, remove aggregate and aerate to reduce moisture content for proper compaction.

3.02 CONSTRUCTION OF AGGREGATE SHOULDERS

A. Construct aggregate shoulders to the elevations and typical sections the plans show, except for minor modifications needed to conform to other work. Use equipment that does not damage or mar the pavement surface, curbs, or appurtenances.

B. Place aggregate directly on the shoulder area between the pavement edge and the outer shoulder limits. Recover uncontaminated material deposited outside the limits and place within the limits.

C. Do not deposit aggregate on the pavement during placement, unless the engineer specifically allows. Do not leave aggregate on the pavement overnight. After placing the shoulder aggregate, keep the pavement surface free of lose aggregate.

D. Spread and compact the aggregate in compacted layers of 6 inches (150 mm) or less. Use standard compaction conforming to ODOT, unless the special provisions specify otherwise.

E. After final compaction, shape the shoulders to remove all longitudinal ridges to ensure proper drainage.

F. Construct shoulders along concrete pavement or concrete base so the completed shoulder is at the approximate grade and cross-section before opening the pavement to public traffic.

G. If the roadway is closed to through traffic during construction, construct the aggregate shoulders before opening the road.

H. If the roadway remains open to through traffic during construction and a 2-inch (50 mm) or more drop-off at the pavement edge exists; eliminate the drop-off within 48 hours after completing the asphalt work.

I. Unless the special provisions specify otherwise, provide aggregate shoulder material compacted to a 4:1 or flatter cross slope from the surface of the pavement edge.

J. Blade, shape and compact the existing shoulder aggregate, before the end of the day's work, to ensure proper drainage while salvaging existing pavement and constructing new pavement. Do not contaminate the shoulder aggregate with deleterious material. Incorporate material obtained from shaping shoulders in the new shoulder, in widening the roadbed, or as the plans show.

3.03 MAINTENANCE

1. Maintain the aggregate base course in a smooth, compacted condition, true to line, grade and cross section, until paving placement.

END OF SECTION

SECTION 02570
FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Expansion joints.
4. Cleanouts.
5. Encasement for piping.
6. Manholes.

1.2 ACTION SUBMITTALS

A. Product Data: For expansion joints.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Product Certificates: For each type of SDR21, from manufacturer.

C. Field quality-control reports.

1.4 GENERAL REQUIREMENTS

A. The contractor shall follow the following notes:
1. The contractor shall be qualified to construct sanitary sewers. All such work shall be constructed according to ODNR specifications.
2. Sanitary sewer pipe and fittings shall be PVC D 3034 SDR 26 (Gravity).
3. Sanitary sewer pipe and fittings shall be PVC D 2241 SDR 26 (Force Main).
4. Sanitary sewer pipe joints shall conform to ASTM D 3212 for PVC (Gravity).
5. Roof drains, foundation drains and other clean water connections to the sanitary sewer system are prohibited.
6. No construction shall commence until all permits have been issued.
7. No additions, deletions or revisions to the sanitary sewer are to be made without prior written approval by the Engineer.
8. Water lines crossing any and all sewers shall have a minimum vertical separation of 18” between the outsides of the water main pipe and the sewer pipe. One full length of water main pipe shall be centered at the point of crossing such that both joints will be equidistant

and as far from the sewer as possible. If water crosses below sanitary sewers, the sewer must be water main material for that span.

9. All laterals shall be PVC Schedule 40.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Sewer Piping:

1. Pipe: ASTM S 2241, SDR 21, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3139 .
3. Gaskets: ASTM F 477, elastomeric seals.
4. Installation: ASTM D-2321

2.2 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ODOT Item 604 and ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 443, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
12. Concrete adjusting sections shall be parged on both interior and exterior surfaces.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 48, Class 30 gray iron unless otherwise indicated.
3. Manhole frames and covers shall be roadway type with deep socket covers. Machine frames and covers to prevent rattling. Provide cover with 12-1/2 inch diameter holes for ventilation.
4. Provide flat slab top, rated for AASHTO H-20 loading, as per plan. The contractor shall submit a catalogue cut for the manhole castings for approval by the Owner and the Engineer in writing prior to ordering this material. Incidental work includes associated earthwork and other activities required to install fully operational manholes.
5. Manholes shall be tested by vacuum testing as described below:
   a. Testing is done after complete assembly of the manhole.
   b. The manhole to pipe connection should be flexible connector, such as K or-N-Seal or equivalent.
   c. All lift holes need to be plugged with a non-shrinking mortar, or equivalent.
   d. The contractor must plug the pipe openings, taking care to securely brace the plugs and pipe.
   e. With the vacuum tester in place
      1) Inflate the compression band to 40 psi to effect a seal between the vacuum base and the structure.
      2) Connect the vacuum pump to the outlet port with the value open.
         - Draw a vacuum to 10" of Hg. and close the value.

6. The test is considered passing if the vacuum remains between 9" Hg. and 10" Hg. in a time greater than one minute. If the initial test fails, the contractor can locate the leak, and the appropriate repairs made.

2.3 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

   a. Invert Slope: 0 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

   a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in "02220 Site Earthwork."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, sewer piping according to the following:

1. Install piping pitched down in direction of flow, at slope as indicated.
2. Install piping with 36-inch minimum cover.
3. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
4. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.

G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

H. The trench shall be excavated to conform with the drawings. Where the sewer is in an existing paved area, the edges of the pavement for the ditch shall be cut in a straight line, parallel to the

pipe on each side. A straight and vertical cut shall be made either prior to excavation or after, but before installation of the permanent pavement repair.

1. All trenching shall be open-cut from the surface and no tunneling will be allowed without the consent of the Engineer. All trenches shall be excavated to the lines and grades as shown on the plans.
2. The bottom of the trench shall be excavated to the width on the drawings. The sides of the trench shall be uniform and vertical. Care shall be taken not to over excavate on the trenches.
3. All trenches excavated below bottom of trench grade shall be refilled to grade with sand or gravel. No extra compensation shall be allowed for this work unless such excavation is ordered by the Engineer.
4. All trenches will be excavated so as to accommodate the proper bedding material as shown. No extra compensation will be made for crushed stone used to bring the trench up to grade.
5. The Contractor shall not, without written permission from the Engineer, open more than four hundred (400) feet of trench in advance of the completed sewer, and the completed backfilling and restoration of the trench to a satisfactory condition. If the Contractor fails to heed the above requirements, the Engineer will refuse payment until these requirements are complied with.
6. All drains, gutters, culverts and sewers for surface drainage are to be kept opened or if unavoidably closed, other provisions are to be made for this drainage. All crossings, culverts or ditches are to be made without extra compensation to the Contractor beyond the extra price of sewer laid.
7. The Contractor shall be required to furnish, put-in-place, and maintain such sheeting, bracing, etc., as may be required to support the sides of the trenches. In excavating for the trench it is essential that the trench bottom be uniform in grade and remain static during backfilling and under all subsequent trench conditions. To insure a uniform depth of stone, the grade of the bottom of the trench shall be graded to within 5/10 of one inch of the plan grade. The stone shall be graded to the same tolerances.
8. The Contractor shall pump, or otherwise remove any water that accumulates in the trenches and shall perform all work necessary to keep the trenches clear from water while the pipe is being laid or masonry units are being constructed. No structure or sewer pipe shall be constructed in water and water shall not be allowed to flow over or rise upon any concrete masonry structure or sewer pipe until the work has been accepted.
9. All water pumped or bailed from the trench or other excavation shall be conveyed in a proper manner to a suitable point of discharge.

I. In excavating, backfilling and laying pipe, care must be taken not to remove or injure any sub-surface structure such as water lines, sewer lines, conduits, etc. If necessary, the Contractor shall, at his own expense, sling, shore-up and maintain a continuous flow in said structure until final acceptance of the work. In the event that a gas line, water line, power cable or conduit, or telephone cable or conduit is broken or damaged, the Contractor shall give immediate notice to the proper authorities and shall be responsible for any damage to persons or property caused by such breaks. Existing sewer flows shall be maintained at all times through whatever means necessary. Contractor shall submit appropriate plan for approval by City.

1. If a service pipe supplying water or gas to an adjoining structure is broken, the Contractor shall repair same at once and at his own expense. The City may, at the Contractor's expense, repair any such service without prior notice to the Contractor. Should it become necessary to move the position of any underground structure, the Contractor may be required to do such work and shall be paid on a force account basis.

J. The Contractor shall comply with Ohio EPA and Health Department Regulations standards for separation of sewer lines from water lines and/or combined sewers.

1. Prior to being installed, each section of the pipe shall be carefully examined for damages and conformation to these specifications. All pipe damaged or deemed not to conform to

these specifications shall be rejected. The faces of all spigots and bells which cannot be made to fit properly, or pipe which has chipped bells or spigots will be rejected. The faces of all spigots ends and of all shoulders on the bells must be true, and be brought in fair contact. All lumps on the face shall be cut away before the pipe is lowered into the trench.

2. The pipe and special fittings shall be laid in the trench so that its interior surface shall conform to the grade and alignment as given by the Engineer. Pipe laying shall be done so as to disturb as little as possible the pipe already laid, and unless otherwise directed by the Engineer, the pipe shall be laid up hill without any break in line or grade form manhole to manhole. Before laying, the bell and spigot shall be wiped free from any dirt and other foreign material and a coating of pipe lubricant applied in accordance with manufacturer's recommendations.
3. At least four (4) joints shall be left exposed for inspection purposes during the working day and a suitable ladder affording easy and safe access for such inspection shall be furnished. When the trench is left for the night or the pipe laying is suspended, the ends of the pipe shall be covered to keep out dirt and other foreign substances.
4. All special fittings, such as wyes, tees and building connections shall be installed at the point indicated by the Engineer or as shown on the plans in accordance with details.

K. Whenever it becomes necessary to leave a section of trench open after the completion of the day's work, the Contractor shall be responsible for:
1. Constructing necessary barricades, lights, etc. to protect the public.
2. Providing the necessary drainage to keep the trench free form water and sewage.
3. Pumping or bailing any water that accumulates in the trenches.
4. Undercutting any portion of the trench that becomes saturated with water.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage sewer according to the following:
1. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

B. Pipe couplings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

a. Unshielded flexible couplings for pipes of same or slightly different OD.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Install FRP manholes according to manufacturer's written instructions.

D. Form continuous concrete channels and benches between inlets and outlet.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

F. Install manhole-cover inserts in frame and immediately below cover.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.7 IDENTIFICATION

A. Materials and their installation are specified in Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Test plastic gravity sewer piping according to ASTM F 1417.

7. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

E. Upon completion of the entire work, the Engineer may inspect the work in part or as a whole and make such test as will satisfy himself that every portion of the contract has been faithfully carried out. Gravity pipe lines from manhole to manhole shall show a round circle of light from one end to the other. Any obstructions found in the sewer shall be removed and the sewer barrel left clean for its entire length.
1. If, in the opinion of the Engineer, a defect exists in the pipe line or its appurtenances, in some place not accessible except by uncovering, the Engineer may order the line to be uncovered. If it is found that after the pipe has been uncovered at the order of the Engineer, no defect exists or that the defect was not the fault of the Contractor, then the expense so incurred by the Contractor shall be borne by the Owner.

2. The Contractor shall provide all equipment, materials, water, labor, etc. needed to perform test in accordance with procedure listed below. All equipment, materials, etc. used shall be checked and approved by the Engineer prior to its use. It shall be the responsibility of the Contractor to ensure the pipe is clean before any tests are made.
3. The cost of testing to be included in the Lump Sum Bid.
4. All gravity conduit shall be subjected to a leakage check. All P.V.C. sewer systems 4" and larger shall be subject to a deflection test. The deflection test shall be completed with a mandrel. Deflection shall not exceed 5%.
5. The air test, for conduits twenty-four (24) inches and under, consists of inserting plugs in the line, thus isolating test sections between manholes. Air is then admitted to the isolated test section until it is under pressure of 3.5 pounds per square inch. All valves leading to or from the test section are then closed and the air supply line disconnected. The time elapsing before the pressure in the test section drops to 2.5 pounds per square inch is noted and recorded.
6. The test section shall be considered as having passed the air test if the elapsed time as noted above shall be equal to or greater than the following times:

Specification Time for Length(L) Shown (min:sec)

1 Pipe Diam-eter (in.)	2 Minimum Time (min: sec)	3 Length for Minimum Time (ft.)	4 Time Longer Length (sec.)	100ft.	150ft.	200ft.	250ft.	300ft	350ft.	400ft.	450ft.
4	3:46	597	.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:51	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306L	28.51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25:852L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

7. All pressure conduits shall be tested as described below:
8. Before testing, the pipeline must be backfilled and braced sufficiently to prevent movement under pressure. Three parts of the line should be considered when testing:

   - The pipe to be tested must be sufficiently backfilled to prevent movement while under test pressure.
   - Joint restraint at fittings should be permanent and constructed to withstand test pressure. If concrete thrust blocks are used, sufficient time must be allowed before testing to permit the concrete to cure. Cure time of seven days is recommended when Type 1 portland cement is used; three days is recommended when Type III high-early portland cement is used.
   - Test ends should be restrained to withstand the appreciable thrust that are developed under test pressure.

9. Procedure**:** The following procedure is based on the assumption that the pressure and leakage tests will be performed at the same time. Separate tests may be made if desired; however, if separate tests may be made, the pressure test shall be made first.
10. Filling the Line: The line should be filled slowly from any available source of potable water. Flow velocity during line filling should not exceed 2 fps (0.6 m/sec). All air shall be expelled by means of taps at high points. The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the engineer. The test pressure shown in Table I shall be maintained by additional pumping if necessary for the specified time during which the system and all exposed pipe, fittings, valves and hydrants shall be carefully examined for leakage. All defective elements shall be repaired or removed and replaced and the test repeated until all visible leakage has been stopped and the allowable leakage requirements have been met.
11. Allowable Leakage: The contractor shall furnish the gauges and measuring device for the leakage test, pump, pipe, connections and all other necessary apparatus, and shall furnish the necessary assistance to conduct the test. The duration of each leakage test shall be two hours, unless otherwise specified, and during the test the main shall be subjected to the pressure required in Table I. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within after the pipe has been filled with water and the air in the pipeline has been expelled. A pressure variation of five psi from the specified test pressure is allowable during test duration. However, determination of actual leakage shall be made after line has been returned to specified test pressure at the end of test duration. No installation will be accepted if the leakage is greater than that shown in Table II.
12. All pipes smaller than 2” shall meet allowable leakage for pipes of 2”.
13. All pipes shall meet the allowable leakage for a working pressure of 50 psi. If the working pressure is greater than 33 psi, the pipe system shall meet the requirements in Table I of this specification.

TABLE I
SYSTEM TEST METHODS

PROCEDURE	PRESSURE	DURATION OF TEST
Simultaneous Pressure & Leakage Tests	150% of Working Pressure at Point of Test, but not less than 125% of Normal Working Pressure at Highest Elevation	Two Hours
Separate Pressure Test	150% of Working Pressure at Point of Test, but not less than 125% of Normal Working Pressure at Highest Elevation	One Hour
Separate Leakage Test	150% of Normal Average Working Pressure of Segment Tested	Two Hours

Note: In no case shall the test pressure exceed the pressure rating of the pipe or fittings, nor that of any connected appurtenances or thrust devices.

TABLE II
ALLOWABLE LEAKAGE FOR PRESSURE PIPE SYSTEMS
IN U.S. GALLONS PER HOUR

Pipe Size, Inches	Nominal Average Pressure in Line – PSI 50	100	150	200	250
	Allowable Leakage per 1000 Ft. or 50 Joints				
2"	.10	.17	.19	.19	.22
4"	.19	.27	.33	.38	.43
6"	.29	.41	.50	.57	.64
8"	.38	.54	.66	.76	.85
10"	.48	.68	.83	.96	1.07
12"	.57	.81	.99	1.15	1.28
14"	.67	.95	1.16	1.34	1.50
16"	.76	1.08	1.32	1.53	1.71
18"	.86	1.22	1.49	1.72	1.92
20"	.96	1.35	1.66	1.91	2.14
24"	1.15	1.62	1.99	2.29	2.56
30"	1.43	2.03	2.48	2.87	3.21
36"	1.72	2.43	2.98	3.44	3.85

3.9 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 02570

SECTION 02620
STORM DRAINAGE PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

Pipe and fittings.

1. Cleanouts.
2. Manholes.
3. Catch basins.
4. Stormwater inlets.
5. Pipe outlets.

1.03 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

Manholes: Include plans, elevations, sections, details, frames, and covers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.06 PROJECT CONDITIONS

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for

gasketed joints. Pipe over 15 inches in diameter shall meet the requirements of ASTM F679-03. Do not mix different manufacturer's products or fittings.

1. Fittings: ASTM D 3034, PVC with bell ends.
2. Gaskets: ASTM F 477, elastomeric seals.

2.02 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets

B. Reinforced-Concrete Horizontal Elliptical Culvert

Comply with ASTM C507.

2.03 CLEANOUTS

A. Plastic Cleanouts:

Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.04 MANHOLES

A. Standard Precast Concrete Manholes:

Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
4. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type as indicated, and top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
7. Steps: 1/2-inch ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
8. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

Description: Heavy duty iron conforming to ASTM A48, Class 20 and rated for AASHTO

H20 loading. Provide non-rocking or machined castings. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

1. Type: Neenah Foundry R1550, Type B lid, or approved equal.

2.05 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

Cement: ASTM C 150, Type II.

1. Fine Aggregate: ASTM C 33, sand.
2. Coarse Aggregate: ASTM C 33, crushed gravel.
3. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.06 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
5. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
6. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

2.07 STORMWATER INLETS

A. Provide precast concrete inlets unless otherwise shown or required.

B. Contractor shall carefully locate all pipe locations, sizes, orientation and elevation prior to

ordering inlets.

C. Precast inlets, shall meet the requirements of ASTM C478.

D. Provide inlets of the size and type indicated on the drawings.

E. Provide pre-cast inlet base. Inlet bottom section may be pre-cast with integral base.

F. Inlets requiring separate base and riser sections, must be provided with standard pipe tongue and groove joints.

G. Seal joints watertight with prefabricated rubber or plastic gaskets or formed in place butyl rubber seal.

H. Frames and Grates: Neenah R-2578 with a Type C Convex grate, or Engineer-approved equal, for 3-foot diameter catch basins. Neenah R-3281-A with a Type C grate, or Engineer-approved equal, for 2-foot by 3-foot inlets.

2.08 PIPE OUTLETS

Provide apron endwalls where shown on the drawings and at the following locations:

Where storm sewers outfall into ditches, swales or other surface water body,

1. On both ends of a culvert pipe (pipe that crosses under a road, sidewalk, trail or other surface feature).

B. Unless otherwise indicated, apron endwalls shall be constructed of the same material, same sidewall thickness and to the same design standards as the pipe they are connected to. Apron endwalls shall be the same diameter as the pipe that they are connected to

C. Apron endwalls for pipe greater than 18” in diameter shall be restrained using a minimum of two pipe ties per section. Pipe ties shall also be used to restrain the first two pipes located immediately upstream of the apron endwall. Pipe ties shall be constructed using galvanized ¾” diameter steel rod and hardware, or other approved materials. Pipe ties shall be bolted through the sidewall of the pipe.

D. Apron endwalls for pipe greater than 18” in diameter shall be provide with pipe gates. Pipe gates shall be constructed of 1” diameter standard steel pipe members with welded connections and spaced no greater than 12” O.C.E.W.. Pipe gate shall be attached to endwall at a minimum of 4 locations using 4”x4”x3/16” thick steel angles and 3/8” galvanized machine bolts. Pipe gates shall be provided with a galvanized finish, unless noted.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 02220.

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as

indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

Install piping pitched down in direction of flow.

1. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
2. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.

1. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3.04 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

3.05 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.06 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.07 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Install outlets that spill onto grade, anchored with concrete, where indicated.

C. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

3.08 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.09 CONNECTIONS

A. Make connections to existing piping and underground manholes.

Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

1. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Where new sewer connects to and existing dissimilar pipe, the connection shall be made with a no hub type couplings meeting the requirements of CISPI 310. Couplings shall have neoprene gaskets with stainless steel shield, and multiple stainless steel clamps with worm gear tightening device. The couplings shall be made specifically for the type and size of pipe materials being connected. Couplings shall be Fernco Husky or approved equal.

3.10 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

Close open ends of piping with at least Insert dimension thick, brick masonry bulkheads.

1. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

Remove manhole or structure and close open ends of remaining piping.

1. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 02220.

3.11 IDENTIFICATION

A. Materials and their installation are specified in Section 02220. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

Submit separate reports for each system inspection.

1. Defects requiring correction include the following:

Alignment: Less than full diameter of inside of pipe is visible between structures.

a. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

b. Damage: Crushed, broken, cracked, or otherwise damaged piping.

c. Infiltration: Water leakage into piping.

d. Exfiltration: Water leakage from or around piping.

Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

2. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

Do not enclose, cover, or put into service before inspection and approval.

1. Test completed piping systems according to requirements of authorities having jurisdiction.

2. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

3. Submit separate report for each test.

4. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

Exception: Piping with soiltight joints unless required by authorities having jurisdiction.

a. Option: Test plastic piping according to ASTM F 1417.

b. Option: Test concrete piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.13 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION

SECTION 02625
SUBDRAINAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

Drainage conduits.

1. Drainage panels.
2. Geotextile filter fabrics.

1.03 ACTION SUBMITTALS

A. Product Data:

Drainage conduits, including rated capacities.

1. Drainage panels, including rated capacities.
2. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.01 DRAINAGE CONDUITS

A. Single-Pipe Drainage Conduits: Smooth-Wall PVC perforated and non-perforated pipe and fittings according to 707.41 of the ODOT Specifications and wrapped in geotextile filter fabric.

Filter Fabric: PP geotextile.

2.02 DRAINAGE PANELS

A. Molded-Sheet Drainage Panels: Prefabricated geocomposite, 36 to 60 inches wide with drainage core faced with geotextile filter fabric.

Manufacturers: Subject to compliance with requirements, :

1. Drainage Core: Three-dimensional, nonbiodegradable, molded PP.

Minimum Compressive Strength: 9,000 lbf/sq. ft. when tested according to ASTM D 1621.

a. Minimum In-Plane Flow Rate: 2.8 gpm/ft of unit width at hydraulic gradient of **1.0** and compressive stress of 25 psig when tested according to ASTM D 4716.

Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater

than 50 percent; complying with the following properties determined according to AASHTO M 288:

Survivability: **Class 2**.

b. Apparent Opening Size: No. 70 sieve, maximum.

c. Permittivity: **0.2** per second, minimum.

Film Backing: Polymeric film bonded to drainage core surface.

2.03 SOIL MATERIALS

A. Soil materials are specified in Section 312000 "Earth Moving."

2.04 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.

Survivability: AASHTO M 288 Class 2.

1. Styles: Flat and sock.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 02220 "Site Earthwork."

3.03 RETAINING-WALL DRAINAGE INSTALLATION

A. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.

B. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive.

C. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.

D. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

E. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

F. Install drainage panels on wall as follows:

Coordinate placement with other drainage materials.

1. Lay perforated drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
2. If weep holes are used instead of drainage pipe, cut 1/2-inch- diameter holes on core side at weep-hole locations. Do not cut fabric.
3. Mark horizontal calk line on wall at a point 6 inches less than panel width above footing bottom. Before marking wall, subtract footing width.
4. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.
5. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Place nails from 2 to 6 inches below top of panel, approximately 48 inches apart. Construction adhesives, metal stick pins, or double-sided tape may be used instead of nails. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
6. If another panel is required on same row, cut away 4 inches of installed panel core and wrap fabric over new panel.
7. If additional rows of panel are required, overlap lower panel with 4 inches of fabric.
8. Cut panel as necessary to keep top 12 inches below finish grade.
9. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.

G. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.04 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

C. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with tape.

D. Add drainage course to top of drainage conduits.

E. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.

F. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.05 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inchesunless otherwise indicated.

1. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of **0.5** percent and with a minimum cover of 36 inches unless otherwise indicated.

2. Lay perforated pipe with perforations down.

3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install thermoplastic piping according to ASTM D 2321.

3.06 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 02620 "Storm Drainage Piping."

B. Cleanouts for Foundation Retaining-Wall Landscaping Subdrainage:

Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

1. In nonvehicular-traffic areas, use NPS 4 PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout 1 inch above grade.

3.07 CONNECTIONS

A. Comply with requirements for piping specified in Section 02620 "Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.08 IDENTIFICATION

A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 02220 "Site Earthwork."

Install PE warning tape or detectable warning tape over ferrous piping.

1. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.09 FIELD QUALITY CONTROL

A. Tests and Inspections:

After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.

1. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION

SECTION 02668
FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for combined water service and fire-service mains.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Architect, Construction Manager and Owner no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of water-distribution service without Owner's written permission.
3. No service connections shall be made to the water main until the main line has been inspected, tested, disinfected and released for taps.

1.7 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151 Class 53, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151 Class 53, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

D. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.2 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. All valves are to be right handed (clockwise) opening direction.
2. All valves to have o-ring water seals on operating rods.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. East Jordan Iron Works, Inc.
   b. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
   c. McWane, Inc.; Kennedy Valve Div.
   d. McWane, Inc.; M & H Valve Company Div.
   e. Mueller Co.; Water Products Div.

4. Nonrising-Stem, Resilient-Seated Gate Valves:

   a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.

5. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

   a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 250 psig.
      3) End Connections: Push on or mechanical joint.
      4) Interior Coating: Complying with AWWA C550.

2.4 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. East Jordan Iron Works, Inc.
   b. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
   c. McWane, Inc.; Kennedy Valve Div.
   d. McWane, Inc.; M & H Valve Company Div.
   e. Mueller Co.; Water Products Div.

2. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, metal-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.5 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Ford Meter Box Company, Inc. (The); Pipe Products Div.
b. Mueller Co.; Water Products Div.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.6 WATER METERS

A. Water meter shall be furnished and installed by the Contractor.

B. Water meter shall be 4-inch Badger Meter, Recordall Turbo Series 1000 (4”)

2.7 WATER METER VAULT

A. Description: Water Meter Vault shall be installed at Near Station 14+00 as shown on the drawings.

B. Description: Water Meter Vault shall include the installation of the water meter; 6-inch double check backflow device (Ames 6" 2000SS w/ gate valves on each side of device)); Gate valves and boxes (located both internally and externally); strainer; flanged piping and adapters; and other appurtenances as required.

C. Water Meter Vault shall be per a 8-ft diameter precast manhole w/ with flat top and Neenah R-1550-A casting and Frame. Vault shall have an inside height of 6-ft. Base of vault shall have a 1-ft diameter cutout filled with clear stone to promote drainage.

2.8 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Mueller Co.; Water Products Div. – Model – Centurion 250, Model A-425

2. Description: Freestanding, with one 4 inch Stortz and one 5 inch Stortz , 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a. Standard: AWWA C502.
b. Pressure Rating: 200 psig minimum.
c. Outlet Threads: Dayton Thread, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
f. Exterior Finish: Primed with Red Oxide Primer and painted with two (2) coats of Red Enamel from breakaway flange to top of hydrant.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to "Earthwork for Utilities" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Underground water-service piping NPS 4 and NPS 6 shall be the following:
   1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.

E. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 shall be same as underground water-service piping.

F. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 10 shall be the following:

   1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

   1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
   2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

B. Make connections larger than NPS 2 with tapping machine according to the following:

   1. Install tapping sleeve and tapping valve according to MSS SP-60.
   2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
   3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
   4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

C. Make connections NPS 2 and smaller with drilling machine according to the following:

   1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
   2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
   3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
   4. Install corporation valves into service-saddle assemblies.
   5. Install manifold for multiple taps in water main.

6. Install curb valve in water-service piping with head pointing up and with service box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

F. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

G. Bury piping with depth of cover over top at least 48 inches, with top at least 12 inches below level of maximum frost penetration.

H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

I. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.5 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
3. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.6 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. “Mega Lug” retainer-length determined by City Inspector.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.8 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface

3.9 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to Caesar Creek Park Standards.

3.10 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA Fire Hydrants: Comply with AWWA M17 and details in drawings.

3.11 CONNECTIONS

A. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

3.12 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.13 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in " Earthwork for Utilities."

3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 02668

SECTION 02705
STABILIZED CRUSHED LIMESTONE SURFACING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: All materials and activities to provide a finished installation of stabilized crushed path surfacing for gravel paths as shown on the drawings and specified herein.

B. Related Sections:
1. Section 02220 – Site Earthwork.

1.03 REFERENCES

A. Standards: Applicable standards of the American Society of Testing Materials (ASTM), current location.

1.04 ACTION SUBMITTALS

A. Product Data: For each product specified a 5 pound sample and sieve analysis for grading of crushed limestone aggregate to be sent to the Resident Project Representative (RPR). All samples must be approved by the RPR prior to installation.

1.05 QUALITY ASSURANCE

A. General: The Contractor is responsible for verifying the quality of the work and shall perform compaction and density tests on request of the RPR and ODNR Project Manager to check compliance with these specifications. A copy of the test reports shall be furnished to the RPR and ODNR Project Manager. The Contractor's testing agency will perform compaction and density tests to check compliance with these specifications.

B. Mock-Up: Construct a mock-up sample 8 feet square, including all materials, stabilizer binders and methods that will be implemented in the work. If accepted, the mock-up sample will be the standard for the remainder of the work. If not accepted, repeat until accepted by the RPR and ODNR Project Manager.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Stockpile satisfactory materials where directed until required. Place and shape stock piles for proper drainage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Prior to the importation of any materials, the Contractor shall provide the RPR and ODNR Project Manager with a certified test lab report of the sieve analysis of the product. The RPR and ODNR Project Manager shall be the final determining factor in establishing compliance. No material shall be brought onto the job site until the initial sieve analysis has been approved in writing. During the course of importation of materials the contractor shall be responsible for continually checking the materials to insure that they continue to meet the specifications.

B. Crushed Limestone Base Aggregate:

1. For use as imported base course for gravel path surface. Limestone shall be dolomitic limestone with predominately tan undertones and minimal striations or variations in color. Type 1 mineral aggregate (0.625 inch or finer crushed limestone) bearing no naturally occurring or worn surfaces. Graduation of the base course shall be:

Sieve	Percent Passing
0.625 inch	100
0.25 inch	50 - 75
No. 40	8 - 24
No. 200	10.0 maximum

C. Crushed Limestone Top Course:

1. For use as top course for gravel path surface. Limestone shall be dolomitic limestone with predominately tan undertones and minimal striations or variations in color. Type 1 mineral aggregate 0.25 inch or finer crushed limestone (No. 4 to Dust), shall consist of crushed ledge rock or talus bearing no naturally occurring or worn surfaces. Stabilizer product to be added prior to delivery to site. Graduation of the top course shall be:

Sieve	Percent Passing
0.375 inch	100
No. 4	95 - 100
No. 8	75 - 80
No.16	55 - 65
No. 30	40 - 50
No. 50	25 - 35
No. 100	20 - 25
No. 200	5 - 15

D. Stabilizer Binder: Patented nontoxic, organic binder that is colorless and odorless concentrated powder that binds decomposed granite or crushed aggregate screenings. Stabilizer by Stabilizer Solutions as supplied by Kafka Granite, phone: 800-852-7415, or approved equal. Blend 12-16 lbs. (refer to manufacturer's recommendations) of the Stabilizer per 1 ton of crushed aggregate screenings. It is critical that Stabilizer be thoroughly and uniformly mixed throughout the aggregate screenings. Bucket blending is not acceptable. Blending with a rake and/or shovel is not acceptable.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protection:

1. Protect the work and adjacent construction against damage during progress of the Work.

2. Do not use construction equipment which will damage existing or new pavement.

3.02 AGGREGATE BASE COURSE

A. Refer to Section 02700 – Aggregate Base Course.

3.03 CRUSHED LIMESTONE BASE AGGREGATE

A. Provide a minimum 4 inch compacted lift of specified Crushed Limestone Base Aggregate true to the elevations either described or implied in the Contract Drawings or as required to match adjacent existing pavements, and a minimum of 6 inches beyond the horizontal layout lines of pavement as indicated on the Contract Drawings.

3.04 CRUSHED LIMESTONE TOP COURSE

A. Provide a minimum 2 inch compacted lift of specified Crushed Limestone Top Course true to the elevations either described or implied in the Contract Drawings.

3.05 SATURATING STABILIZED SURFACE PROFILE

A. Water heavily to achieve full depth moisture penetration of the Stabilized surface profile. WATER ACTIVATES STABILIZER. To achieve saturation of stabilized surface profile, 25-45 gallons of water per 1-ton must be applied. During water application randomly test for depth using a probing device to the final depth.

1. Where sub-grade or lift of soil material must be moisture conditioned before compaction, uniformly apply water to surface of sub grade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

2. Before compaction, moisten or aerate each layer as necessary to provide optimum content. Compact each layer to required percentages of maximum dry density or relative dry density for each area classification.

3. Do not perform compaction operations on excessively wetted soils.

3.06 COMPACTION

A. General: Control soil compaction during construction providing minimum percentage of density specified for area classification. Do not allow equipment traffic to overly compact areas beyond specified percentages. Remediate over compaction as directed by the

Engineer including ripping, re-grading and re-compaction or over-excavation and in-kind replacement per plan.

B. Percentage of Maximum Density Requirements: Compact aggregate material to not less than the following percentages for maximum density:

1. Imported aggregate base material for Crushed Limestone Base – 95% S.P.D.
2. Imported Crushed Limestone Top Course – 95% S.P.D.

3.07 CLEANING

A. Pick up and remove from the site surplus materials, equipment and debris resulting from the work of this Section.

B. Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed. Any plowing program required during the winter months shall involve the use of a rubber baffle on the plow blade or wheels on the plow that lifts the blade 0.25 inch off the paved surface.

C. During the first year, a minor amount of loose aggregate will appear on the paved surface 1/16 inch to 0.25 inch). If this material exceeds 0.25 inch, redistribute the material over the entire surface. Water thoroughly to the depth of 1 inch. Compact with power roller of no less than 1000 pounds. This process should be repeated as needed.

D. If cracking occurs, sweep fines into the cracks, water thoroughly and hand tamp with an 8 inch – 10 inch hand tamp plate.

END OF SECTION

SECTION 02745

ASPHALT PAVEMENT AND PAVEMENT REPAIR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Cold milling of existing asphalt pavement.
   2. Hot-mix asphalt patching.
   3. Hot-mix asphalt paving.
   4. Hot-mix asphalt overlay.
   5. Asphalt surface treatments.

B. Related Requirements:
   1. Section 02220 Site Earthwork for subgrade preparation, fill material.
   2. Section 02500 Aggregate Base Course for unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

1.3 UNIT PRICES

A. Work of this Section is affected by Pavement and Subgrade Repair unit price as well as Asphalt paving unit prices.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.
   2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
   3. Job-Mix Designs: For each job mix proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by ODOT.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: per ODOT Item 703.05.

C. Fine Aggregate: per ODOT Item 703.05.

D. Mineral Filler: per ODOT Item 703.07.

2.2 ASPHALT MATERIALS

A. Shall be per ODOT Item 401.03.

B. Asphalt Base Course: ODOT Item 301, Asphalt Concrete Base, PG 64-22

C. Asphalt Surface Course: ODOT Item 448, Asphalt Concrete Surface Course, Type 1, medium traffic, PG 64-22

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
   2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
   3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING AND PAVEMENT REPAIR

A. Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically to a depth of 12 inches. Remove excavated material. Install aggregate base course to a depth of 10 inches and compact. Recompact existing unbound-aggregate base course to form new subgrade.

B. Placing Patch Material: Fill excavated pavement areas with 2-inch thick hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

C. Pavement repair shall be as marked in the field by the RPR and distributed throughout the site.

3.3 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

3.4 PLACING HOT-MIX ASPHALT

A. Place asphalt courses according to ODOT Item 401.

B. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
   2. Place hot-mix asphalt surface course in single lift.
   3. Spread mix at a minimum temperature of 250 deg F.
   4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
   5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

C. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
   2. Complete a section of asphalt base course before placing asphalt surface course.

D. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.

B. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

C. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

D. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

E. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch
   2. Surface Course: 1/8 inch
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: ODNR will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
      a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.8 TRAFFIC CONTROL

A. Provide the appropriate signage and flagging for pavement repair work, following ODOT standards. Maintain at least one lane of traffic open at all times. In the event that one-way traffic is required for a short period, station flagmen at the appropriate locations to maintain safe passage conditions. Since the project is occurring during a low-use season for the park, it is not anticipated that there will be a lot of traffic.

END OF SECTION

SECTION 02780
PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes painted markings applied to asphalt pavement.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

1.04 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degree F for alkyd materials.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Aexcel Inc.
2. Benjamin Moore & Co.
3. Color Wheel Paints & Coatings
4. Columbia Paint & Coatings
5. Conco Paints
6. Coronado Paint; Division of INSL-X Products Corporation
7. Diamond Vogel Paints
8. Dunn-Edwards Corporation
9. Ennis Traffic Safety Solutions, Inc.
10. Frazee Paint
11. General Paint
12. Kwal Paint
13. MAB Paints
14. McCormick Paints
15. Miller Paint
16. Parker Paint Mfg. Co. Inc.
17. PPG Industries
18. Pratt & Lambert

19. Rodda Paint Co.
20. Rohm and Haas Company; a subsidiary of The Dow Chemical Company
21. Scott Paint Company
22. Sherwin-Williams Company

2.02 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type S; colors complying with FS TT-P-1952.

1. Colors: White parking, crosswalk; Yellow for double yellow centerline.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.02 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

2. Broadcast glass beads uniformly into wet markings at a rate of 6 lbs./gal.

3.03 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 02870
SITE FURNISHINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fire extinguisher cabinets
2. Fire extinguisher
3. Fire life rings
4. Emergency Call Box

B. Related Sections:

1. None

1.03 ACTION SUBMITTALS

A. The Contractor shall review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the work or in the contract of the Owner or any separate contractor, all shop drawings, product data and samples required by the contract documents.

B. By approving and submitting shop drawings, product data and samples, the Contractor represents that he has determined and verified all materials, field measurements and field construction criteria related thereto, or will do so, and that he has checked and co-ordinated the information contained within such submittals with the requirements of the work and of the contract documents.

C. Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Owner's Representative's approval of shop drawings, product data or samples unless the Contractor has given written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the shop drawings, product data or samples by the Owner's Representative's approval thereof.

D. Contractor shall direct specific attention, in writing or on resubmitted shop drawings, product data or samples, to revisions other than those requested by the Owner's Representative on previous submittals.

E. No portion of the work requiring submission of a shop drawing, product data or sample shall be commenced until the submittal has been approved by the Owner's Representative.

F. Contractor shall submit three prints of all shop and setting drawings every time a submission is made until final approval is received.

G. Drawings submitted shall be marked with the name of the project, numbered consecutively and bear the stamp of approval of the Contractor as evidence that the drawings have been checked by the Contractor. Any drawings submitted without this stamp of approval will not be considered and will be returned to the Contractor for re-submittal.

H. Samples shall be of sufficient size to clearly illustrate options and details.

I. For product data, submit four copies of full color, standard manufacturer's catalogue information, and manufacturer's materials specification for each specified product.

PART 2 - MATERIALS

2.01 LIT FIRE EXTINGUISHER CABINET

A. Fire extinguisher cabinets (LFECs) shall match the dockside utility centers (DUCs) chosen for the project.

B. Approved manufacturers:

a. "Fire Sentinel, LBB-41," International Dock Products, 3101 S.W. 25th Street, Bay 106 Pembroke Park, Florida 33009; dockproducts.com; 800-909-3625.

b. "Firehouse Marina," Eaton Marina Power and Lighting, 149 Warwick Court, Williamsburg, Virginia 23185; 800-723-8009.

c. "Ensign Fire Captain," TDI Products, 589 Levy Road, Atlantic Beach, Florida 32233; 904-242-0742.

C. LFECs shall be powder-coated white stainless steel or aluminum. Shall be capable of holding a 20-lb fire extinguisher. Fire extinguisher must be mounted so that the bottom is at least 4 inches above the walking surface, and the top is not more than 3.5 feet above the walking surface.

D. Lighting:

a. LFEC shall be equipped with a LED light source oriented to illuminate the deck.

b. LFEC lens shall be clear Lexan.

c. The lumen pattern from the diffuser will not interfere or impede navigation and/or docking in berths.

2.02 UNLITFIRE EXTINGUISHER CABINET

A. Unlit Fire extinguisher cabinets (ULFECs) shall be red and pole mounted to the docks at ADA heights..

B. Approved manufacturers:

a. "Brooks' Mark II Series Fire Extinguisher Cabinets," http://www.brooksequipment.com;.
b. Approved equivalent

2.03 FIRE EXTINGUISHER

A. Shall be 20-lb dry chemical, color red, manufactured by Amerex, Kiddie, model Tri-Class (ABC), or ODNR approved equal.

2.04 LIFE RINGS

A. Life rings shall be Jim Buoy, UV-Resistant Type IV Hard Shell Life Ring Buoys, 30" diameter, or ODNR approved equal. Color shall be orange. Shall conform to U.S. Coast Guard regulations.

B. Life ring shall be mounted to the back of the fire extinguisher cabinet using a stainless steel or aluminum hook designed to securely hold a life ring.

2.05 EMERGENCY CALL BOX

A. Emergency Call box shall be Viking Electronics E-1600A-EWP Red, ADA compliant. Hands free Emergency Phone with Enhanced Weather Protection or ODNR Approved equivalent.

PART THREE – EXECUTION

3.01 INSTALLATION

A. All furnishings shall be anchored per manufacturer's instruction using stainless steel vandal resistant screws and/or anchors. Mount fire extinguisher cabinets directly to dock decking using appropriate fasteners for the decking material. Emergency Call Box location shall be at the Marina Services Building and shall be determined by ODNR Project Manager and the RPR.

3.02 ADJUSTMENTS

A. It is understood and agreed that should minor changes and deviation from the locations established on the drawings be required by the ODNR Project Manager or RPR, this shall be done by the Contractor at no additional cost thereto.

END OF SECTION

01SECTION 02890
WOOD DECKING, POSTS, RAILS AND SUPPORT FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Wood decking posts.
2. Railings for bridge decks.
3. Railings for guard rails.
4. Support framing for bridge decks.

1.03 DEFINITIONS

A. Wood Terminology: ASTM D245.

Commercial and common names for hardwood and softwood timber and lumber: ASTM D1165.

Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.

Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

Timber: Lumber of 5 inches nominal or greater in least dimension.

Reference agencies, and the abbreviations used to reference them, include the following:

1. ALSC: American Lumber Standard Committee.
American Institute of Timber Construction: Timber Construction Manual.
ASTM: American Society of Testing Materials.
AWPA: American Wood Preservers Association: Book of Standards.
DOC: Department of Commerce.
FSC: Forest Stewardship Council.
ICC-ES: ICC Evaluation Service.
NeLMA: Northeastern Lumber Manufacturers' Association.
NLGA: National Lumber Grades Authority.
RIS: Redwood Inspection Service.
SPIB: The Southern Pine Inspection Bureau.
WCLIB: West Coast Lumber Inspection Bureau.
WWPA: Western Wood Products Association.

1.04 ACTION SUBMITTALS

A. Product Data: For all Fasteners.

1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

For metal framing anchors. Include installation instructions.

Edit as necessary based on types of fasteners and hardware being used

For all fasteners including joist and beam hangers, screws, nails and miscellaneous hardware.

1.05 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.

For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

All lumber. Indicate maximum moisture content prior to and after preservative treatment.

1.06 QUALITY ASSURANCE

A. Lumber Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

Qualifications of Installer: Minimum five years' experience with design and installation of commercial boardwalk systems.

Lumber Manufacturer and Preservative Treater:

1. The lumber manufacturer shall provide all quality control and inspection of materials furnished and shall be graded and stamped accordingly. Stamping shall include mill origin, species and grade. Stamping may be removed only following field verification.

The preservative treater shall ensure all grading stamps are legible after treatment. The treater shall also ensure wood is treated in accordance with applicable "Standard Quality Control Procedures for Wood Preserving Plants" in accordance with AWPA standards. All lumber shall be clearly labeled with type of preservative and net amount of preservative retained.

Field Treatment of Preservative Treated Material: Field treat all saw cuts, routs, kerfs, holes and injuries to the surface of the preservative treated lumber by brushing, dipping, soaking or coating. Spraying is not permitted.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

Handle and store plastic lumber to comply with manufacturer's written instructions.

All lumber with damaged surfaces shall not be used.

PART 2 - PRODUCTS

2.01 LUMBER, GENERAL

A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.

1. Factory mark each item with grade stamp of grading agency.

For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece.

Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.

Provide dressed lumber, S4S, unless otherwise indicated.

Certified Wood: Boards and dimension lumber shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

Maximum Moisture Content Following Preservative Treatment:

2. Boards: 15 percent.

Dimension Lumber: 15 percent.

Timber: 15 percent.

2.02 WOOD DECKING

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

Unless otherwise noted, provide lumber that is surfaced on all sides (S4S) at mill prior to grading and preservative treatment.

Board Decking: Three inch x six inch radius-edged decking. Select structural grade.

Southern pine; SPIB.

2.03 WOOD RAILINGS

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

Unless otherwise noted, provide lumber that is surfaced on all sides (S4S) at mill prior to grading and preservative treatment.

Bridge Railing Boards: Select structural grade.

Southern pine; SPIB.

Timber Guardrail: Select structural grade

1. Southern pine; SPIB; rough - sawn.

2.04 SUPPORT FRAMING

A. Deck Framing: Select structural grade.

Southern pine; SPIB.

2.05 POSTS

Timber Posts: Select structural grade.

1. Bridge Rail Posts: Southern pine (S4S).
2. Timber Guardrail: Southern pine: SPIB; rough-sawn.
3. Signage Posts: Western red cedar (S4S).

2.06 PRESERVATIVE TREATMENT

A. Pressure treat boards with waterborne preservative according to AWPA U1; Use Category UC3B for exterior construction not in contact with the ground, and Use Category UC4A for items in contact with the ground and water.

Pressure treat timber with waterborne preservative according to AWPA U1; Use Category UC4A.

Pressure treat poles with waterborne preservative according to AWPA U1; Use Category UC4A.

Preservative Chemicals:

1. Alkaline Copper Quaternary (ACQ) “Type D.

B. Use process for boards that includes water-repellent treatment.

After treatment, redry all treated wood to 15 percent maximum moisture content.

Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.

1. For items indicated to receive a stained or natural finish, [mark each piece on surface that will not be exposed].

C. Application: Treat all wood unless otherwise indicated to the following preservative retention levels:

1. Framing members: 0.60 pcf.

Sills and ledgers: 0.60 pcf.

Posts: 0.60 pcf.

Decking: 0.40 pcf.

2.07 FASTENERS

A. Stainless steel.

General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails and screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Use fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or ASTM F 2329 unless otherwise indicated.

   For pressure-preservative-treated wood, use stainless-steel fasteners.

   For wood decking, use stainless-steel fasteners.

   For redwood, use hot-dip galvanized-steel fasteners.

B. Nails: ASTM F 1667.

Power-Driven Fasteners: ICC-ES AC70.

Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

Stainless-Steel Bolts: ASTM F 593, Alloy Group 1 or 2 (ASTM F 738M, Grade A1 or Grade A4); with ASTM F 594, Alloy Group 1 or 2 (ASTM F 836M, Grade A1 or Grade A4) hex nuts and, where indicated, flat washers.

2.08 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.

Install wood decking with crown up.

Secure decking to framing with screws.

Install metal framing anchors to comply with manufacturer's written instructions.

Do not splice structural members between supports.

Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Apply copper naphthenate field treatment to comply with AWPA M4, to cut surfaces of preservative-treated lumber.

Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. ICC-ES AC70 for power-driven fasteners.

   "Fastening Schedule" in ICC's International Building Code.

   "Fastener Schedule for Structural Members" and "Alternate Attachments" in ICC's International Residential Code for One- and Two-Family Dwellings.

C. Use screws unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side are exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.

For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced.

3.03 ELEVATED DECK JOIST FRAMING INSTALLATION

A. General: Install joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists where framed into wood supporting members by using wood ledgers as indicated or, if not indicated, by using metal joist hangers. Do not notch joists.

Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

Lap members framing from opposite sides of beams or girders. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

Provide solid blocking of 2-inch nominal thickness by depth of joist at intervals of 96 inches o.c. between joists and at additional locations as indicated on the drawings.

3.04 RAILING INSTALLATION

Railings: Fasten freestanding railings to posts with countersunk-head wood screws or rail bolts.

END OF SECTION

SECTION 02911
SOIL PREPARATION

PART ONE - GENERAL

1.01 SUMMARY

A. Section Includes: This section describes placement of all soil materials designated as "Topsoil," “Engineered Soil, and “Cobble Stone Mulch” on the drawings or in the specifications. Supply topsoil for landscape work (seeding and planting) from both on-site and off-site sources. Materials for engineered soil and cobble stone mulch for biofiltration shall be supplied from off-site sources.

1.02 SUBMITTALS

A. Material Test Reports - Topsoil: Prior to starting placement of topsoil material or delivery from off site sources, conduct topsoil testing for existing on-site topsoil stockpiles and imported topsoil from off-site sources. Submit one certified electronic copy of soil test reports to the ODNR Project Manager and RPR for approval for each topsoil stockpile designated for general site use. Topsoil units that do not meet the soil requirements specified will not be permitted for use on site.

B. Material Test Reports – Engineered Soil: Conduct testing for Engineered Soil Mix both on individual components and after mixing. Submit one certified electronic copy of soil test reports to the ODNR Project Manager and RPR for approval prior to placement on site.

C. Sample: Provide 1 gallon bag sample of Cobble Stone Mulch. Identify source.

D. Product Information: Provide manufacturer’s product information on Geotextile Fabric for Cobble Stone Mulch.

1.03 QUALITY CONTROL

A. All soil sampling and testing shall comply with procedures specified in U.S.D.A. Ag. Handbook 60, Diagnosis and Improvement of Saline and Alkali Soils.

B. Testing Laboratories: Use certified facilities normally engaged in agronomic soil testing as approved by the RPR.

C. Required Tests

1. Fertility: pH (ASTM D4972), nitrate nitrogen, ammonium nitrogen, phosphate phosphorous, potassium, calcium, magnesium, zinc, iron, manganese.
2. Physical properties: organic content (ASTM D2974) and particle size distribution.
3. Soil texture analysis.
4. Amendment recommendations for seeding and planting.

D. Conduct topsoil testing for each soil test unit as follows:

1. Existing off-site location: 1 sample per acre of site to be excavated.

PART TWO – PRODUCTS

2.01 TOPSOIL FOR GENERAL SITE USE

A. Topsoil for general site use shall consist of salvaged on site topsoil and/or imported topsoil material, and shall be a fertile, friable, sandy loam or loam surface soil without admixture of subsoil.

B. Imported topsoil shall be per ODOT Section 659.

2.02 ENGINEERED SOIL FOR BIOFILTRATON

A. Engineered Soil Mix shall consist of a mix of 70% sand, 20% topsoil from off-site sources and 10% compost, as described below.

B. Sand shall be washed, medium coarse, ASTM C33.

C. Topsoil shall meet the requirements of Part 2.01, above.

D. Compost may include:

1. Leaf compost, screened and free of trash and other debris.
2. Standard commercial grade compost of sheep or cow manure.

E. Compost shall meet the following requirements:

1. Particle size: 98% of the compost shall be capable of passing the ¾" sieve. All material shall be capable of passing the 1" sieve, and shall be free of rocks, gravel, wood, debris, physical or pollutant contaminants, and of noxious weeds and their seeds.
2. Organic matter: 40%-60% organic matter content
3. pH: Range of 6 to 8
4. Soluble salts: Electrical conductivity below 10 dS m-1
5. Moisture content: Between 35%-50% by weight

F. Combine all materials uniformly by volume to the above percentages. The pH range shall be 6.0 to 8.0.

2.03 COBBLE STONE MULCH FOR BIOFILTRATON

A. Cobble Stone Mulch shall be "Oversize Gravel" product, 2" - 4" size range, unwashed and ungraded material, as provided by Bushelman Supply Company,250 Marion Road, Cincinnati, OH 45215, (513)771-9121, http://www.bushelman.com, or equivalent.

B. Geotextile Fabric for Cobble Stone Mulch shall be Subsurface Drainage Geotextile, per Section 02220.

2.04 TOPSOIL FOR WETLAND MITIGATION AREAS

A. Topsoil salvaged for use in wetland mitigation areas shall only be used in the proposed wetland mitigation areas along the lake edge, and shall consist of salvaged on site topsoil from existing wetlands. The purpose of this requirement is to assist the propagation of local native plants that exist in this topsoil as roots, live cuttings and dormant seeds in the proposed wetland areas. Therefore, admixture of plants and their roots, stones less than 4" diameter, and other material from the organic soil horizon is desired in this material (screening/shredding shall not be performed).

B. Topsoil for wetland mitigation areas shall not require testing or be amended in any way.

PART THREE - EXECUTION

3.01 SUBGRADE SOIL PREPARATION

A. Remove or mow all vegetation on subgrade surface to a height of 2". No vegetation shall remain that will interfere with placing topsoil or establishing landscape or wetland areas. Remove all rocks, debris, and litter that will compromise placing topsoil.

B. Chisel plow subgrade to a depth of 12" to alleviate compaction. Special attention shall be taken to reduce compaction on internal temporary haul roads and demolished existing roadbeds. Additional plowing in these areas may be required as directed by ODNR Project Manager.

3.02 PLACING TOPSOIL FOR GENERAL SITE USE

A. Topsoil and restore all areas disturbed by the Contractor's operations.

B. Amend imported topsoil as necessary as determined by soil test and directed by RPR.

C. Place topsoil to achieve final grades indicated on drawings and specified herein, to within 1-inch of design elevation or as otherwise noted, allowing for settlement. Place topsoil to provide a minimum thickness of 8 inches. Compact lightly to prevent settlement.

D. Grades shall meet existing grades at contract limits and shall be ½ inch below pavement surfaces.

E. Finished grades shall slope to drain, be free of depressions or other irregularities after thorough settlement and compaction of soil, and shall be uniform in slope between grading controls and the elevations indicated.

F. Topsoil must not be applied in any condition that would hamper a successful seeding or planting operation, including application while in a frozen or muddy condition, or when subgrade is too wet as indicated by saturation or flooding.

3.03 PLACING ENGINEERED SOIL FOR BIOFILTRATION

A. Engineered Soil shall be backfilled into biofiltration basin to depths shown on Drawings using methods of placement that minimize compaction.

B. Engineered Soil must not be applied in any condition that would hamper a successful installation, including application when subgrade is too wet as indicated by saturation or flooding.

3.04 PLACING COBBLE STONE MULCH FOR BIOFILTRATION

A. Establish and maintain required lines and elevations. Place Geotextile Fabric to separate Cobble Stone Mulch from Engineered Soil. Cut and wrap fabric at edges to maintain ends below finish grade.

B. Apply Cobble Stone Mulch and rake to distribute stones evenly at the depth indicated on Drawings.

3.05 PLACING TOPSOIL FOR WETLAND MITIGATION AREAS

A. Place topsoil in wetland areas to achieve final grades indicated on drawings and specified herein, to within 1-inch of finished elevation, allowing for settlement.

B. Prior to spreading designated wetland topsoil, first place a base course of topsoil for general site use over the subgrade to a thickness of 10 inches in the wetland areas. Place 2 inches of topsoil for wetland mitigation areas over this base to bring the overall topsoil depth to 12 inches. (Note: wetland topsoil layer may be thickened if sufficient quantities are stockpiled.) Compact lightly to prevent settlement.

C. Topsoil must not be applied in any condition that would hamper a successful seeding or planting operation, including application while in a frozen or muddy condition, or when subgrade is too wet as indicated by saturation or flooding.

D. Any designated wetland topsoil remaining in the stockpile after all wetland areas have been graded may be screened and/or shredded to be used as general site topsoil with approval of ODNR Project Manager.

END OF SECTION

SECTION 02920
TURF SEEDING

PART ONE - GENERAL

1.01 SUMMARY

A. Section includes providing all work, material, labor, equipment and supervision necessary to complete finish grading of topsoil, seeding of Turf Grass Seed Mix and ODOT Seed Mix, mulching and maintenance operations as indicated on plans and specified herein.

1.02 SUBMITTALS

A. Certification of Conformance or Compliance

1. Seed: From seed vendor for each grass-seed mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

2. Fertilizer: Provide data on fertilizer showing type, manufacturer and composition.

3. Herbicides/pesticides: Product label and manufacturer's application instructions specific to project

4. Mulch: Provide data on mulch including supplier and assurance that mulch is free of weed seeds.

5. Provide information on methods of sowing seed.

6. Provide watering / irrigation plan with system design that outlines methods for maintaining seed bed moisture as described herein. Reliance on natural precipitation will not be allowed.

B. Certified Test Reports

1. Topsoil (See Section 02911)

C. Schedules

1. Within two weeks following the issuance of the Notice to Proceed, submit a project work schedule to the ODNR Project Manager and RPR indicating the dates of each of the following events:

a. Seed installation – verify compliance with seeding schedules for each mix.

b. Substantial Completion of work – verify compliance with seeding schedules for each mix.

1.03 REGULATORY REQUIREMENTS

A. Comply with applicable regulations for fertilizer and herbicide composition and application. Include evidence of compliance from applicable agencies having jurisdiction over herbicide/pesticide application and copies of applicator’s current license.

1.04 QUALITY ASSURANCE

A. Contractor's Qualifications
   1. The work of this section shall be performed by a qualified Contractor with a minimum of 5 years experience specializing in seeding and landscape installations.

   2. Contractor's Field Supervision: Maintain an experienced full-time supervisor on project site when work is in progress.

B. Delivery, Storage and Handling
   1. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

   2. Bulk Materials:
      a. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
      b. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
      c. Accompany each delivery of bulk materials with appropriate certificates.

C. Guarantee
   1. The Contractor shall guarantee the germination of seed installed during the regular seeding season.

   2. Final grade tolerances to within 1/2" of the design elevations and provide for positive drainage.

   3. The Contractor shall provide materials and labor necessary to correct any deficiencies in the above during the warranty period.

1.05 FIELD CONDITIONS

A. Planting Restrictions: Plant seed during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of seeding completion.

   1. Turf Grass Seed: April 1 to May 15 **OR** August 15 to September 30
      (Minimum soil temperature 50°F+)

   2. ODOT Seed Mix: Per ODOT Item 659.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.05 FINAL ACCEPTANCE

A. Final acceptance shall be granted at the end of the maintenance period specific to each mix provided that turf installations meet the following criteria as determined by ODNR Project Manager and RPR:

1. Satisfactory Seeded Turf Grass Seed: At end of maintenance period (including three mowings as described under the Maintenance item), seeded areas shall be accepted provided all requirements, including maintenance, have been met, and a healthy, uniform, close stand of specified grass is established, free of weeds and surface irregularities. Bare spots greater than a 5-inch square will not be accepted.

2. Satisfactory Seeded ODOT Seed Mix: Per ODOT Item 659.23.

3. Seeding shall be completed and approved before final acceptance of the project can be made by the ODNR Project Manager. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

PART TWO – PRODUCTS

2.01 TOPSOIL

A. Topsoil as specified in Section 02911.

2.02 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:
   1. Quality: State certified seed of grass species as listed below.

   2. **Turf Grass Seed** shall be as provided by the following trademarked blend or equivalent: Survivor Turf-type Tall Fescue Blend, Seed Research of Oregon, 27630 Llewellyn Road, Corvallis, Oregon 97333, 800.253.5766, www.sroseed.com. Turf Grass seed mix shall be applied at a minimum rate of 8 pounds / 1,000 square feet.

   3. **ODOT Seed Mix** shall be Class 2 mixture, per ODOT Item 659.

2.03 MULCH

A. Straw: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

2.04 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium, in the composition recommended by topsoil test results.

2.05 EROSION CONTROL MATERIALS

A. Erosion mat shall be ‘Slope Erosion Mat’ in accordance with Section 02200, Soil Erosion and Sedimentation Control.

2.06 WATER

A. Water shall be free of wastewater effluent or other hazardous chemicals. On-site sources of water will be available, based on pumping water from the lake. Confirm water source prior to commencing work.

B. A temporary / portable, above ground irrigation system is required for watering turf grass seeded areas. The system shall have the ability to be operated without moving hoses or sprinklers daily around the site between newly seeded areas (i.e. system can be set to water one area for the required maintenance period), and may be automated with a timer. Standard temporary sprinkler irrigation systems may be used that provide the coverage rates specified herein.

2.07 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction

B. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART THREE - EXECUTION

3.01 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by deleterious material or liquid is present in soil, remove the soil and contamination as directed by ODNR Project Manager and replace with new planting soil.

3.02 FINISH GRADING

A. Per Section 02911, Soil Preparation.

3.03 PREPARATION

A. Grade Preparation

1. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations. Protect grade stakes set by others until directed to remove them.

2. Subgrade and finish grade preparation shall be in accordance with site earthwork requirements, and topsoil shall be a minimum 12 inches deep.

4. Immediately before seeding, scarify, loosen, float and drag topsoil as necessary to bring it to the proper condition. Remove foreign matter larger than 1 inch in diameter.

5. If the prepared grade is eroded or compacted by rainfall prior to fertilizing, rework the topsoil to the full depth.

B. Layout

1. All seeding zone boundaries shall be surveyed and staked on the project site by the Contractor, and shall extend to the limits of construction disturbance. Where edge of area planted with a Native Upland or Wetland Seed Mix adjoins an area seeded with mown Turf Grass Seed, wood stakes painted with orange tips shall be placed at a minimum interval of 20-feet along the boundary to fully delineate the limits of the lawn mowing area (including trails) for establishment. These stakes shall remain in place for the entire native seed maintenance period; see Section 02922 and Section 02925. Replace stakes as necessary during the maintenance period.

2. No seed mix shall be installed until the grade preparation and layout have been approved by the ODNR Project Manager and RPR.

3. The ODNR Project Manager and RPR reserve the right to adjust seed limits without adjusting total seeded areas, to meet field conditions, at no additional cost.

C. Do not sow seed when weather conditions are unfavorable, such as during drought or high winds.

3.04 DRILL SEEDING

A. Perform drill seeding using approved equipment such as cultipacker seeders and grass seed drills.

B. Drill the seed uniformly to a maximum depth of ¼ inch. All areas shall be seeded in at least two directions, with perpendicular passes. Seeds shall not be covered by more than ¼ inch of soil. The seeding device shall lightly roll the seed bed to provide good moisture contact between the seed and soil.

C. Water thoroughly and immediately with a fine mist until soil is soaked to a depth of 3 inches. Puddling of water is unacceptable. Maintain soil in a moist condition as described under maintenance, below.

D. Protect seeded areas with erosion control blankets where indicated on Drawings; install and anchor per manufacturer's written instructions.

E. On all areas not protected by erosion control blankets, spread straw mulch evenly at the rate of 2 tons per acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Place all mulch on given areas within 48 hours after seeding. A mechanical blower may be used to apply mulch material, provided the machine has been specifically designed and approved for this purpose. Anchor the mulch by crimping into soil with suitable mechanical equipment.

3.05 TURF RENOVATION

A. Renovate or restore existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles. Blend newly seeded areas into adjacent existing lawns.

B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

C. Mow, dethatch, core aerate, and rake existing turf.

D. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

E. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them offsite.

F. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

G. Apply initial fertilizer required for establishing new turf as recommended by topsoil test report and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

H. Apply Turf Grass Seed, water, and maintain as required for new turf.

3.06 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with park operations and others in proximity to the Work. Notify ODNR Project Manager before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.07 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Upon completion of turf grass installation, remove from the site and legally dispose of the following:

1. Surplus subgrade and unsuitable soil material.
2. Stone and foreign matter.
3. Trash and debris.

C. Excess topsoil not required for lawns or planting shall be stockpiled on site for future use as directed by the ODNR Project Manager.

D. Erect temporary fencing or barricades and warning signs as required to protect newly seeded areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after seed is established.

E. Remove nondegradable erosion-control measures after grass establishment period.

3.08 MAINTENANCE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of Landscape Installer. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Turf Grass Seed: 60 days from date of substantial completion, including a minimum of three maintenance mowings.

2. ODOT Seed Mix: 60 days from date of substantial completion.

3. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

B. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, edging, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that occurs within 90 days following installation because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.

2. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

C. Seeded areas are to be watered daily to maintain adequate surface soil moisture for proper seed germination (½-inch of water daily, keeping soil uniformly moist to a depth of 3 inches). Daily watering shall continue for not less than 21 days following seeding. Thereafter, apply ½-inch of water twice weekly until final acceptance. **A temporary, above ground irrigation system is required for watering seeded areas as described above**, and shall remain in place until final acceptance of each seed mix.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch.

2. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

D. Mowing:
1. Mow Turf Grass Seed and ODOT Seed Mix when the grass has reached a height of 3 inches. Mow to a height of 2-1/2 inches. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not let clippings lay in clumps. Do not mow when grass is wet.

E. Turf Postfertilization: Apply commercial fertilizer to Turf Grass Seed areas after initial mowing and when grass is dry. Use fertilizer that provides actual nitrogen of 1 lb/1000 sq. ft. to turf area.

F. Keep lawns clean and protected from damage during the maintenance period. Debris which accumulates shall be removed from the site. Promptly repair damaged lawns except those damaged by major storms.

END OF SECTION

SECTION 02922
WETLAND SEEDING

PART ONE - GENERAL

1.01 SUMMARY

A. Section Includes

1. Procurement, scheduling, installation, maintenance and warranty of all Emergent Wetland seeding and Wet Prairie seeding in accordance with the plans and as specified herein.

2. Work under this section requires knowledge of wetland plant communities and installation of seed mix within wetland areas.

1.02 SUBMITTALS

A. Certification of Conformance or Compliance

1. Submit for approval to the ODNR Project Manager and RPR a written description, nursery acknowledgement, or manufacturer's product sheet of the following:

a. Name and location of seed supplier(s) and a complete list of the seed mix that is being supplied before the seed mix is ordered.

b. Geographic origins of each seed species.

c. Percentage of Pure Live Seed (PLS) for each species or commitment by supplier to provide germination results.

d. Description of seed supplier's testing facilities, including means and methods for performing germination tests on each species for verification of compliance with PLS requirements.

e. Method of seeding, including all equipment to be used and manufacturer's specifications for care and handling.

f. Tackifier: manufacturer's specifications and recommended rates of application.

g. Provide watering or irrigation plan with system design that outlines methods for maintaining seed bed moisture as described herein. The system shall have the ability to be operated without moving hoses or sprinklers around the site between seeded/planted areas (i.e. system can be set to water one area for the required maintenance period), and may be automated with a timer. Submit irrigation plan and schedule for approval prior to landscape installation. Reliance on natural precipitation will not be allowed. Temporary irrigation system shall be designed by an irrigation consultant with a minimum of five years experience working in the field. Coordinate with requirements of other landscape specifications.

B. Contractor Qualifications

1. Documentation: List projects of similar scope, and type. Contractor must provide references for at least three projects of similar size and scope as wetland mitigation / stream realignment area seeding (5 acres minimum) performed within the past five (5)

years. The ODNR reserves the right to contact any and all references to obtain, without limitation, contractor's performance on the listed projects.

Information provided for each project shall include:

a. Project Name and Acreage
b. Client / Agency / Department / Office for Which Performed
c. Project Completion Date
d. Owner's Project Manager or Other Representative
e. Current Client Contact Person / Phone Number / Email Address
f. Dollar Value of Contract

C. Schedules

1. Within four weeks following the issuance of the Notice to Proceed, submit a project work schedule to the ODNR Project Manager and RPR indicating the dates of each of the following events:

a. Seed installation – verify compliance with seeding schedules for seed mix.

b. Substantial Completion of work – verify compliance with seeding schedules for each mix.

D. Maintenance Schedule

1. Prior to the issuance of Substantial Completion, submit instructions and a schedule for warranty maintenance (duration of **one year**) of Emergent Wetland Seed Mix and Wet Prairie Seed Mix areas including irrigation, weed control, and invasive species eradication. Coordinate wetland seeding maintenance with Section 02930 "Planting" and Section 02925 "Native Upland Seeding."

E. Maintenance Report Forms

1. Submit Maintenance Report Forms following completion of each maintenance visit. The forms shall cross-reference the Maintenance Schedule, although it is understood that weather conditions will be a factor in determining frequency of maintenance. Payment for maintenance will not be made without submission of Maintenance Report Forms.

1.03 QUALITY CONTROL

A. General

1. Many of the wetland and wildflower seed species identified in the various mixes included in this Specification will require field collection, cleaning, drying and storage. This is a specialized operation that requires a thorough knowledge of:
   - Native species identification
   - Seed maturation periods
   - Seed testing and germination reports
   - Cleaning, drying, storage, and mixing procedures
   - Native seed installation.

B. All seed shall comply with applicable sections of the following references:

1. State of Ohio Agricultural Seed Law, Chapter 907.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Seed shall be delivered to the site in its original, unopened container, labeled as to weight, analysis, and manufacturer. Store any seed delivered prior to use in a manner safe from damage from heat, moisture, rodents, or other causes. Any seed damaged after acceptance shall be replaced by the Contractor.

1.05 SITE CONDITIONS

A. General

1. Graded wetland areas of the site shall be seeded with the specified mixes as outlined in Part B of this section, "Seeding Season."

2. Upon authorization to proceed with the work, the Contractor shall examine and verify the acceptability of the job site. Notify the ODNR Project Manager if conditions detrimental to plant growth are encountered such as rubble fill, adverse drainage conditions or obstructions. Do not proceed with the work until unsatisfactory conditions have been corrected or resolved in writing by the ODNR Project Manager. Coordination is required to ensure rainfall/groundwater seepage does not result in soil moisture conditions that will cause excessive rutting during seeding and mulching operations. Failure to meet this requirement will not be an acceptable reason for not installing the seed as specified.

3. Where seeding occurs in close proximity to other site improvements or areas to remain undisturbed such as existing wetlands and uplands areas, care shall be taken to not disturb the existing conditions. Any areas damaged during planting operations shall be promptly restored to their original condition at no cost to the Owner.

B. Seeding Season

1. Seeding of all Wetland Seed Mixes shall occur as early as possible during the growing season in the early spring. Actual dates shall be based on spring weather conditions, approximately between April 15 and May 30. If grading operations are not completed until after May 30, the site shall be seeded with the following temporary seed mix to hold for seed installation the following spring:

Temporary Seed Mix:

Botanical Name	Common Name	PLS lbs/Acre
Avena sativa	Common Oat	128.00
Lolium multiflorum	Annual Rye	15.00
	Total:	**143.00**

2. In the event that seed collection, cleaning, and drying is not completed at the time of installation, the pre-qualified installer shall be required to hand broadcast remaining species (overseeding) at a time that shall be pre-approved by the Owner's Representative.

1.06 GUARANTEE

A. Warrant all seed species to be true to botanical name.

B. The Contractor shall establish a dense cover of specified species in all areas seeded under the contract as outlined under this Section. For all seeded zones included under this section, the

RPR shall conduct warranty field inspections of all seeded areas at the end of the first growing season.

C. After receiving a Notice of Substantial Completion (defined in Part 3.05), maintain seeded areas as outlined in Part 3.04 of this Section until Final Acceptance. Reseed all bare areas greater than 5 square feet in size.

D. Areas which do not meet the contract requirements shall be reseeded within acceptable planting dates as directed by the ODNR Project Manager.

PART TWO - PRODUCTS

2.01 SEED

A. Origin

1. All herbaceous seed material shall originate from local Ohio sources to the extent possible, specifically from USDA Plant Hardiness Zone 5 or lower.

B. Quality

1. Seed shall be fresh, clean, dry, new-crop seed tested for minimum percentages of purity and germination.

C. Testing Requirements

1. The seed weights noted under Part 2.01, D. of this section indicate weight per acre in Pure Live Seed (PLS) and shall mean the total amount of fresh new crop seed per acre for all species listed. In the event that the seed supplier is unable to verify the percentage of PLS prior to installation, the supplier shall be required to submit germination reports that identify the actual germination rates of each specified species. Based on these results, the Contractor will be required to provide supplemental seeding for each species that does not meet the specified rates of PLS. All reports shall be submitted within 30 days following seed installation and additional seeding will be required the following spring for species that were previously installed at rates less than specified.

D. Mix Composition

1. Emergent Wetland Seed Mix:

Botanical Name	Common Name	PLS Ounces/Acre
Permanent Grasses/Sedges/Rushes:		
Leersia oryzoides	Rice Cut Grass	15.00
Juncus effusus	Common Rush	1.00
Juncus torrei	Torreys Rush	1.00
Scirpus acutus	Hard-stemmed Bulrush	2.50
Scirpus pungens	Chairmaker's Rush	4.00
Scirpus tabernaemontanii	Softstem Bulrush	6.00
	Total	**29.50**
Forbs:		
Acorus calamus	Sweet Flag	10.00
Alisma spp.	Water Plantain (Mix)	2.00
Asclepias incarnata	Swamp Milkweed	5.00
Cephalanthus occidentalis	Buttonbush	5.00
Decodon verticillatus	Swamp Loosestrife	5.00
Eupatorium maculatum	Spotted Joe-Pye Weed	0.50
Hibiscus spp.	Rosemallow (Mix)	10.00
Iris virginica	Blue Flag	15.00
Peltandra virginica	Arrow Arum	100.00
Penthorum sedoides	Ditch Stonecrop	0.50
Polygonum spp.	Pinkweed (Mix)	15.00
Pontederia cordata	Pickerel Weed	20.00
Sagittaria latifolia	Common Arrowhead	2.00
Sparganium americanum	American Bur Reed	15.00
Sparganium eurycarpum	Common Bur Reed	15.00
Verbena hastata	Blue Vervain	1.00
	Total	**221.00**

Mix Statistics				
Native Component	PLS lbs./Acre	PLS Seeds/Acre	PLS Seeds/Sq. Ft.	% of Native Mix
Forbs	13.81	800,319	18.37	24.43%
Grasses	1.84	2,475,378	56.83	75.57%
Total Natives	15.66	3,275,697	75.20	100.00%
Cover	N/A	N/A	N/A	
Totals	15.66	3,275,697	75.20	

2. Wet Prairie Seed Mix:

Botanical Name	Common Name	PLS Ounces/Acre
Permanent Grasses/Sedges:		
Carex stipata	Common Fox Sedge	10.00
Carex cristatella	Crested Oval Sedge	10.00
Carex vulpinoidea	Brown Fox Sedge	4.00
Elymus virginicus	Virginia Wild Rye	100.00
Glyceria striata	Fowl Manna Grass	4.00
Juncus dudleyi	Dudley's Rush	0.25
Juncus torreyi	Torrey's Rush	0.50
Leersia oryzoides	Rice Cut Grass	6.00
Panicum virgatum	Switch Grass	6.00
Scirpus atrovirens	Dark Green Rush	3.00
Scirpus cyperinus	Wool Grass	1.00
Spartina pectinata	Prairie Cord Grass	30.00
	Total	**174.75**
Temporary Cover:		
Avena sativa	Common Oat	360.00
Lolium multiflorum	Annual Rye	100.00
	Total	**460.00**
Forbs:		
Alisma spp.	Water Plantain (Mix)	2.00
Asclepias incarnata	Swamp Milkweed	10.00
Aster novae-angliae	New England Aster	2.00
Aster puniceus	Swamp Aster	1.00
Eupatorium maculatum	Spotted Joe-Pye Weed	1.00
Helenium autumnale	Sneezeweed	1.00
Iris virginica	Blue Flag	30.00
Liatris spicata	Marsh Blazing Star	3.00
Lobelia cardinalis	Cardinal Flower	0.25
Lobelia siphilitica	Great Blue Lobelia	0.25
Lycopus americanus	Common Water Horehound	0.50
Mimulus ringens	Monkeyflower	0.25
Polygonum hydropiperoides	Water Pepper	20.00
Polygonum pensylvanica	Knotweed	20.00
Sagittaria latifolia	Common Arrowhead	3.00
Solidago graminifolia	Grass Leaved Goldenrod	0.50
Verbena hastata	Blue Vervain	1.50
Vernonia fasciculata	Smooth Ironweed	4.00
Zizia aurea	Golden Alexanders	4.00
	Total	**104.25**

Mix Statistics				
Native Component	PLS lbs./Acre	PLS Seeds/Acre	PLS Seeds/Sq. Ft.	% of Native Mix
Forbs	6.52	2,236,225	51.34	26.74%
Grasses	10.92	6,126,136	140.64	73.26%
Total Natives	17.44	8,362,361	191.97	100.00%
Cover	28.75	4,343,800	99.72	
Totals	46.19	12,706,161	291.69	

2.02 TOPSOIL

A. Topsoil for wetland seeding shall occur from two sources, consisting of salvaged existing wetland topsoil and general site topsoil. Phase 1B Contractor shall be responsible for placing general site topsoil in wetland seed areas designated for grading under Phase 1B. Salvaged existing wetland topsoil shall be placed in the wetland areas along the lake edge as part of the Phase 1A scope of work.

2.03 FERTILIZER

A. Fertilizer is prohibited.

2.04 EQUIPMENT

A. A spinning-disc type broadcaster with a calibration gauge shall be used to broadcast the seed over the designated areas.

2.05 WATER

A. Water shall be free of wastewater effluent or other hazardous chemicals. An on-site source of water will be available based on pumping water from the lake. Confirm water source prior to commencing work.

B. A temporary / portable, above ground irrigation system is required for watering seeded areas. The system shall have the ability to be operated without moving hoses or sprinklers daily around the site between newly seeded areas (i.e. system can be set to water one area for the required maintenance period), and may be automated with a timer. Standard temporary sprinkler irrigation systems may be used that provide the coverage rates specified herein.

2.06 EROSION CONTROL MAT

A. Erosion mat shall be ‘Slope Erosion Control Mat’ or ‘Channel Erosion Control Mat’ as shown on the Drawings and in accordance with Section 02200, Soil Erosion and Sedimentation Control.

PART THREE – EXECUTION

3.01 SEED PROCUREMENT

A. Immediately following contract award, the Contractor shall begin seed procurement. During the four week procurement period, the Contractor shall locate all seed suppliers, collectors and producers and set up supply contracts to ensure that the quantity and quality of seed material will be available during the specified planting window.

B. Any species substitutions MUST be approved by the RPR prior to seed procurement.

3.02 SEED INSTALLATION

1. General

    1. Do not sow seed during adverse weather or when wind speeds exceed five miles per hour.

    2. Do not sow seed in wetland areas where standing water is present. Dewater if necessary.

    3. **Seed shall be installed prior to installation of emergent plug plant material, per Specification 02930.**

B. Grade Preparation

    1. Subgrade and finish grade preparation shall be in accordance with site earthwork (Section 02220) and soil preparation requirements (Section 02911) and the drawings.

    2. Prior to seeding in stream area, repair any ruts, rills, or gullies greater than 2 inches in depth to create smooth continuous grades. Undulating grades are acceptable/desirable in lake edge emergent wetlands per drawing details.

    3. If the prepared grade is eroded or compacted by rainfall prior to seeding, rework the surface to a depth of 5 inches and 2 inches (depth of salvaged wetland topsoil) in emergent wetlands at lake edge.

    4. No further grade preparation is required.

C. Layout

    1. All seeding zone boundaries shall be surveyed and staked on the project site by the Contractor, and shall extend to the limits of construction disturbance. No seed mix shall be installed until the grade preparation and layout have been approved by the ODNR Project Manager and RPR. Where edge of area planted with a Wetland Seed Mix adjoins an area seeded with mown Turf Grass Seed, wood stakes painted with orange tips shall be placed at a minimum interval of 20-feet along the boundary to fully delineate the limits of the lawn mowing area (including trails) for establishment. These stakes shall remain in place for the entire native seed maintenance period, see Part 3.04. Replace stakes as necessary during the maintenance period.

    2. The ODNR Project Manager reserves the right to adjust seed limits without adjusting total seeded areas, to meet field conditions, at no additional cost to the Owner.

D. Method

    1. For spring seeding, the area into which the seed mix will be installed should not have any live or dead plant material taller than 2”. If plant material is taller than this height, the area should be mowed as closely to the ground as possible and cut material removed.

    2. Seed can be sown directly into the cut plant stubble.

    3. Break bulk seed mix down into 0.5 acre quantities for better management to provide even distribution over the site. A carrying agent such as vermiculite must be pre-approved by the RPR. Sawdust and sand are inadequate carriers and shall not be used.

4. Light seeds, awned seeds, or bearded seeds tend to rise to the top of the spreader, therefore, installer shall adjust the broadcaster accordingly as planting commences.

5. **Keep the topsoil in a saturated condition for 6 weeks following seeding**; afterward, apply 2" water during the growing season if rain has not occurred for more than one week. Do not apply water with such a force as to disturb seed, seedlings, and/or topsoil, or that would run off soil surface.

E. Erosion Control Mat

1. Install erosion control mat as indicated in details on the Drawings on all areas specified to receive it. Wetland seed mixes shall be installed prior to placement of erosion mat.

2. Reseed all disturbed edges immediately following mat installation and work seed into mat.

3.03 CLEANING, REMOVAL, AND RESTORATION

A. All areas over which hauling operations have been conducted shall be kept clean on a daily basis. Promptly remove all materials spilled on pavement.

B. Upon completion of seed installation, remove from the site and legally dispose of all trash and debris including any material removed during grade preparation.

C. Restore adjacent areas damaged by operations under the contract. Restoration shall include finish grading and seeding as required to match existing grade, and maintenance of restored areas.

D. Any damage by the Contractor to established or newly seeded areas not within the project scope of work shall be repaired and reseeded at no cost to the Owner.

3.04 MAINTENANCE

A. General maintenance for both seed mixes:

1. Site visits shall occur monthly during the first growing season to assess site conditions and correct issues with erosion and weeds. Reports documenting these monthly visits and any completed maintenance activities shall be submitted to ODNR Project Manager within two weeks following the visit.

2. After spring installation, seeded areas shall be inspected with the ODNR Project Manager in attendance twice during the first growing season: once in early summer and once in early fall. Notify the ODNR Project Manager of the inspection no less than 2 weeks prior to an inspection. A report of the findings will be issued by the Maintenance Provider including agreed upon maintenance required.

3. Any bare spots greater than 5 square feet shall be reseeded in accordance with the original specifications.

4. Maintain the seeded areas weed-free by pulling small weeds as they emerge, shaking dirt loose from roots. Do not hand-pull large weeds (greater than 10") the first year following seeding because such action could disrupt small native seedlings.

5. Weeds shall be spot treated with an appropriate herbicide, which must be executed by a certified pesticide applicator using the wick or soaked-glove methods only. Follow all

manufacturer label directions, including timing, mixing, application, and clean-up. Spraying herbicide is not allowed at any time in the wetland seeded areas.

B. Wet Prairie Seed Mix mowing:

1. During the first growing season following seeding, mow the wet prairie seeded areas each time (up to 4 times) that the plant material (annual and perennial weeds) has reached a height of 12-16 inches tall. Mow to a height of 6 inches. A flail-type mower that will finely shred mowed clippings must be used. Alternatively, a string trimmer may be utilized but all clippings and seed heads must be removed from the site following cutting.

3.05 ACCEPTANCE

A. Substantial Completion for entire site will be granted upon the successful completion of all seeding and verification by the ODNR Project Manager and RPR that all work has been installed in accordance with the plans and specifications. Following Wetland Seed Mix installation, the ODNR Project Manager, RPR and Contractor shall conduct a Substantial Completion Inspection on all seeded areas. Following this inspection, re-topsoil, reseed, mulch, and re-apply erosion control mat as directed by the RPR. Bare spots greater than 5 square feet shall be reseeded in accordance with the original specifications. All repairs shall be completed within one week following the inspection. All reseeding shall occur at no additional cost to the Owner.

B. Final Acceptance will be granted one full growing season following installation of the wetland seed dependent on achieving specification requirements. Final Acceptance will be granted if the seeded area shows an even distribution and germination of specified native plants and cover crop across the project site. All maintenance reports required in Part 1.02 shall have been submitted throughout the maintenance period. There shall be clear evidence that the specified maintenance mowing has occurred to control weed species. Failure to meet the requirement (weed-free seed beds) shall result in the Contractor extending the maintenance period until the specified cover is achieved at no additional cost to the Owner.

END OF SECTION

SECTION 02925
NATIVE UPLAND SEEDING

PART ONE - GENERAL

1.01 SUMMARY

A. Section Includes

1. Procurement, scheduling, installation, maintenance, and warranty of all areas designated for Prairie Seed Mix, Biofiltration Seed Mix, and Savannah Seed Mix, and in accordance with the Plans and as specified herein.

1.02 SUBMITTALS

A. Certification of Conformance or Compliance

1. Submit for approval to the ODNR Project Manager and RPR a written description, nursery acknowledgement, or manufacturer's product sheet of the following:

a. Name and location of seed supplier(s) and a complete list of the seed mix that is being supplied before the seed mix is ordered.

b. Geographic origins of each seed species.

c. Percentage of Pure Live Seed (PLS) for each species or commitment by supplier to provide germination results.

d. Description of seed supplier's testing facilities, including means and methods for performing germination tests on each species for verification of compliance with PLS requirements.

e. Method of seeding, including all equipment to be used and manufacturer's specifications for care and handling. Provide information on seed carrier, where applicable.

f. Tackifier: manufacturer's specifications and recommended rates of application.

g. Erosion control blankets, including anchor.

h. Provide watering or irrigation plan with system design that outlines methods for maintaining seed bed moisture as described herein. The system shall have the ability to be operated without moving hoses or sprinklers around the site between seeded/planted areas (i.e. system can be set to water one area for the required maintenance period), and may be automated with a timer. Submit irrigation plan and schedule for approval prior to landscape installation. Reliance on natural precipitation will not be allowed. Temporary irrigation system shall be designed by an irrigation consultant with a minimum of five years experience working in the field.

B. Contractor Qualifications

1. Documentation: List projects of similar scope, and type. Contractor must provide references for at least three projects of similar size and scope as project native upland seeding (5 acres minimum) performed within the past five (5) years. The ODNR reserves the right to contact any and all references to obtain, without limitation, contractor's performance on the listed projects.

Information provided for each project shall include:

a. Project Name and Acreage
b. Client / Agency / Department / Office for Which Performed
c. Project Completion Date
d. Owner's Project Manager or Other Representative
e. Current Client Contact Person / Phone Number / Email Address
f. Dollar Value of Contract

C. Schedules

1. Within four weeks following the issuance of the Notice to Proceed, submit a project work schedule to the ODNR Project Manager and RPR indicating the dates of each of the following events:

a. Seed installation – verify compliance with seeding schedules for each seed mix.

b. Substantial Completion of work – verify compliance with seeding schedules for each mix.

D. Maintenance Schedule

1. Prior to the issuance of Substantial Completion, submit instructions and a schedule for warranty maintenance (duration of **one year**) for Savannah Seed Mix, Biofiltration Seed Mix, and Prairie Seed Mix areas including irrigation, weed control, and invasive species eradication. Coordinate seeding maintenance with Section 02930 "Planting" and Section 02922 "Wetland Seeding".

E. Maintenance Report Forms

1. Submit Maintenance Report Forms following completion of each maintenance visit. The forms shall cross-reference the Maintenance Schedule, although it is understood that weather conditions will be a factor in determining frequency of maintenance. Payment for maintenance will not be made without submission of Maintenance Report Forms.

1.03 QUALITY CONTROL

A. General

1. Many of the grass and wildflower seed species identified in the various mixes included in this Specification will require field collection, cleaning, drying and storage. This is a specialized operation that requires a thorough knowledge of:
   - Native species identification
   - Seed maturation periods
   - Seed testing and germination reports
   - Cleaning, drying, storage, and mixing procedures
   - Native seed installation.

B. All seed shall comply with applicable sections of the following references:

1. State of Ohio Agricultural Seed Law, Chapter 907.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Seed shall be delivered to the site in its original, unopened container, labeled as to weight, analysis, and manufacturer. Store any seed delivered prior to use in a manner safe from damage from heat, moisture, rodents, or other causes. Any seed damaged after acceptance shall be replaced by the Contractor.

B. All seed shall be delivered to the site in sealed containers and labeled, in compliance with the Federal Seed Act.

1.05 SITE CONDITIONS

A. General

1. Graded upland areas of the site shall be seeded with the specified mixes as outlined in Part B of this section, “Seeding Season.”

2. Upon authorization to proceed with the work, the Contractor shall examine and verify the acceptability of the job site. Notify the ODNR Project Manager if conditions detrimental to plant growth are encountered such as rubble fill, adverse drainage conditions or obstructions. Do not proceed with the work until unsatisfactory conditions have been corrected or resolved in writing by the ODNR Project Manager. Coordination is required to ensure rainfall/groundwater seepage does not result in soil moisture conditions that will cause excessive rutting during seeding and mulching operations. Failure to meet this requirement will not be an acceptable reason for not installing the seed as specified.

3. Where seeding occurs in close proximity to other site improvements or areas to remain undisturbed such as existing wetlands and uplands areas, care shall be taken to not disturb the existing conditions. Any areas damaged during planting operations shall be promptly restored to their original condition at no cost to the Owner.

B. Seeding Season

1. Seeding of all Native Upland Seed Mixes shall occur as early as possible during the growing season in the early spring. Actual dates shall be based on spring weather conditions, approximately between April 15 and May 30. If grading operations are not completed until after May 30, the site shall be seeded with the following temporary seed mix to hold for seed installation the following spring:

Temporary Seed Mix:

Botanical Name	Common Name	PLS lbs/Acre
Avena sativa	Common Oat	128.00
Lolium multiflorum	Annual Rye	15.00
	Total:	**143.00**

2. In the event that all seed collection, cleaning, and drying is not completed at the time of installation, the pre-qualified installer shall be required to hand broadcast remaining species (overseeding) at a time that shall be pre-approved by the ODNR Project Manager.

1.06 GUARANTEE

A. Warrant all seed species to be true to botanical name.

B. The Contractor shall establish a dense cover of specified species in all areas seeded under the contract as outlined under this Section. For all seeded zones included under this section, the RPR shall conduct warranty field inspections of all seeded areas at the end of the first growing season.

C. After receiving a Notice of Substantial Completion (defined in Part 3.06), maintain seeded areas as outlined in Part 3.05 of this section until Final Acceptance. Reseed all bare areas greater than 5 square feet in size.

D. Areas which do not meet the contract requirements shall be reseeded within acceptable planting dates as directed by the ODNR Project Manager.

PART TWO - PRODUCTS

2.01 SEED

A. Origin

1. All herbaceous seed material shall originate from local Ohio sources to the extent possible, specifically from USDA Plant Hardiness Zone 5 or lower.

B. Quality

1. Seed shall be fresh, clean, dry, new-crop seed tested for minimum percentages of purity and germination.

C. Testing Requirements

1. The seed weights noted under Part 2.01, D. of this section indicate weight per acre in Pure Live Seed (PLS) and shall mean the total amount of fresh new crop seed per acre for all species listed. In the event that the seed supplier is unable to verify the percentage of PLS prior to installation, the supplier shall be required to submit germination reports that identify the actual germination rates of each specified species. Based on these results, the Contractor will be required to provide supplemental seeding for each species that does not meet the specified rates of PLS. All reports shall be submitted within 30 days following seed installation and additional seeding will be required the following spring for species that were previously installed at rates less than specified.

D. Seed Mix Composition

1. Prairie Seed Mix:

Botanical Name	Common Name	PLS Ounces/Acre
Permanent Grasses/Sedges:		
Bouteloua curtipendula	Side-Oats Gramma	48.00
Bromus kalmii	Prairie Brome	16.00
Elymus canadensis	Canada Wild Rye	48.00
Elymus virginicus	Virginia Wild Rye	64.00
Juncus tenuis	Slender Rush	0.20
Panicum virgatum	Switch Grass	12.00
Schizachyrium scoparium	Little Bluestem	48.00
	Total	**236.20**
Temporary Cover:		
Avena sativa	Common Oat	360.00
Lolium multiflorum	Annual Rye	100.00
	Total	**460.00**
Forbs:		
Allium cernuum	Nodding Onion	6.00
Asclepias tuberosa	Butterfly Milkweed	10.00
Aster novae-angliae	New England Aster	2.00
Aster laevis	Smooth Blue Aster	3.00
Echinacea purpurea	Purple Coneflower	12.00
Eryngium yuccifolium	Rattlesnake Master	3.00
Heliopsis helianthoides	Oxeye Sunflower	10.00
Liatris spicata	Marsh Blazing Star	2.50
Monarda fistulosa	Wild Bergamot	1.50
Pycnanthemum virginianum	Mountain Mint	0.25
Ratibida pinnata	Yellow Coneflower	5.00
Rudbeckia hirta	Black-Eyed Susan	2.00
Solidago ohioensis	Ohio Goldenrod	2.00
Solidago rigida	Stiff Goldenrod	1.50
Verbena hastata	Blue Vervain	1.50
Zizia aurea	Golden Alexanders	2.00
	Total	**64.25**

Mix Statistics				
Native Component	PLS lbs./Acre	PLS Seeds/Acre	PLS Seeds/Sq. Ft.	% of Native Mix
Forbs	4.02	1,581,960	36.32	46.27%
Grasses	14.76	1,837,500	42.18	53.73%
Total Natives	18.77	3,419,460	78.50	100.00%
Cover	28.75	4,343,800	99.72	
Totals	47.52	7,763,260	178.22	

2. Biofiltration Seed Mix:

Botanical Name	Common Name	PLS Ounces/Acre
Permanent Grasses/Sedges:		
Andropogon gerardii	Big Bluestem	10.00
Carex cristatella	Crested Oval Sedge	1.50
Carex stipata	Common Fox Sedge	1.50
Carex vulpinoidea	Brown Fox Sedge	1.50
Elymus virginicus	Virginia Wild Rye	24.00
Glyceria striata	Fowl Manna Grass	1.25
Panicum virgatum	Switch Grass	12.00
Scirpus atrovirens	Dark Green Rush	1.00
Scirpus cyperinus	Wool Grass	0.50
Sorghastrum nutans	Indian Grass	10.00
Spartina pectinata	Prairie Cord Grass	3.00
	Total	**66.25**
Temporary Cover:		
Avena sativa	Common Oat	360.00
Lolium multiflorum	Annual Rye	100.00
	Total	**460.00**
Forbs:		
Asclepias incarnata	Swamp Milkweed	3.00
Aster novae-angliae	New England Aster	1.50
Eupatorium maculatum	Spotted Joe-Pye Weed	0.75
Eupatorium perfoliatum	Boneset	0.50
Helenium autumnale	Sneezeweed	1.00
Liatris spicata	Marsh Blazing Star	3.00
Lobelia cardinalis	Cardinal Flower	0.25
Lobelia siphilitica	Great Blue Lobelia	0.50
Monarda fistulosa	Wild Bergamot	1.50
Physostegia virginiana	Obedient Plant	1.00
Pycnanthemum virginianum	Mountain Mint	0.25
Ratibida pinnata	Yellow Coneflower	2.25

Rudbeckia hirta	Black-Eyed Susan	2.00
Solidago ohioensis	Ohio Goldenrod	0.50
Verbena hastata	Blue Vervain	1.00
Vernonia fasciculata	Smooth Ironweed	1.00
Zizia aurea	Golden Alexanders	0.75
	Total	**20.75**

Mix Statistics				
Native Component	PLS lbs./Acre	PLS Seeds/Acre	PLS Seeds/Sq. Ft.	% of Native Mix
Forbs	1.29	1,509,275	34.65	49.17%
Grasses	4.14	1,566,750	35.97	50.93%
Total Natives	5.43	3,076,025	70.62	100.00%
Cover	28.75	4,343,800	99.72	
Totals	34.18	7,419,825	170.34	

3. Savannah Seed Mix:

Botanical Name	Common Name	PLS Ounces/Acre
Permanent Grasses/Sedges:		
Andropogon gerardii	Big Bluestem	16.00
Bromus kalmii	Prairie Brome	20.00
Bromus pubescens	Hairy Wood Chess	12.00
Carex grayi	Common Bur Sedge	5.00
Cinna arundinacea	Common Wood Reed	3.00
Elymus canadensis	Canada Wild Rye	64.00
Elymus hystrix	Bottlebrush Grass	16.00
Elymus villosus	Silky Wild Rye	16.00
Panicum virgatum	Switch Grass	20.00
Schizachyrium scoparium	Little Bluestem	8.00
Sorghastrum nutans	Indian Grass	10.00
	Total	**190.00**
Temporary Cover:		
Avena sativa	Common Oat	360.00
Lolium multiflorum	Annual Rye	100.00
	Total	**460.00**
Forbs:		
Agastache nepetoides	Yellow Giant Hyssop	1.00
Aster novae-angliae	New England Aster	2.00
Blephilia hirsuta	Hairy Wood Mint	0.50
Campanula americana	Tall Bellflower	1.00
Echinacea purpurea	Purple Coneflower	12.00
Eupatorium purpureum	Sweet Joe-Pye Weed	0.75
Gaura biennis	Biennial Gaura	2.00

Heliopsis helianthoides	Oxeye Sunflower	10.00
Maianthemum racemosum	False Solomon's Seal	8.00
Monarda fistulosa	Wild Bergamot	1.50
Penstemon digitalis	Foxglove Beard Tongue	1.00
Pycnanthemum virginianum	Mountain Mint	0.25
Rudbeckia hirta	Black-Eyed Susan	4.00
Veronicastrum virginicum	Culver's Root	0.50
Zizia aurea	Golden Alexanders	8.00
	Total	**53.50**

Mix Statistics				
Native Component	PLS lbs./Acre	PLS Seeds/Acre	PLS Seeds/Sq. Ft.	% of Native Mix
Forbs	3.34	2,114,850	48.55	48.55%
Grasses	11.88	2,240,700	51.44	51.45%
Total Natives	15.22	4,355,550	99.99	100.00%
Cover	28.75	4,343,800	99.72	
Totals	43.97	8,699,350	199.71	

2.02 TOPSOIL

A. Topsoil for seeding shall be as described in Section 02911.

2.03 MULCH

A. Straw

1. Provide stalks from oats, wheat, rye, barley, or rice that are free of weeds, mold, and other objectionable material.

2. Straw shall be in an air-dry condition and suitable for placing with commercial mulch-blowing equipment.

2.05 TACKIFIER/CRIMPING

A. Binding agent used to hold mulch material in place shall be a clear non-staining latex-based tackifier or a water-soluble polymer such as Curasol, Terr Tack or Fibrex Spray Sod.

B. Asphalt emulsion adhesive is not permitted.

C. Crimping devices (serrated disk) is an acceptable alternative to the Tackifier and is the preferred method of anchoring.

2.04 EROSION MAT

A. Erosion mat shall be 'Slope Erosion Control Mat' in accordance with Section 02200, Soil Erosion and Sedimentation Control.

2.05 FERTILIZER

A. Fertilizer is prohibited.

2.06 EQUIPMENT

A. Drill seeder, such as Truax or Tye drill, or John Deere Rangeland drill or drop seeder/spreader with cultipacker, such as Brillion or John Deere.

2.07 WATER

A. Water shall be free of wastewater effluent or other hazardous chemicals. An on-site source of water will be available based on pumping water from the lake. Confirm water source prior to commencing work.

B. A temporary / portable, above ground irrigation system is required for watering seeded areas. The system shall have the ability to be operated without moving hoses or sprinklers daily around the site between newly seeded areas (i.e. system can be set to water one area for the required maintenance period), and may be automated with a timer. Standard temporary sprinkler irrigation systems may be used that provide the coverage rates specified herein.

2.08 NONSELECTIVE HERBICIDE

A. EPA registered and approved glyphosate-based herbicide (broad spectrum, non-persistent) intended for vegetation removal while preparing seed beds and for maintenance during establishment period and recommended surfactants and adjuvants.

PART THREE - EXECUTION

3.01 SEED PROCUREMENT

A. Immediately following contract award, the Contractor shall begin seed procurement. During the four week procurement period, the Contractor shall locate all seed suppliers, collectors and producers and set up supply contracts to ensure that the quantity and quality of seed material will be available during the specified planting window.

B. Any species substitutions MUST be approved by the RPR prior to seed procurement.

3.02 SEED INSTALLATION

A. General

1. Do not sow seed during adverse weather or when wind speeds exceed five miles per hour.

2. Do not sow seed in areas where standing water is present.

3. **Seed shall be installed prior to installation of emergent and perennial plugs, per Specification 02930.**

B. Site preparation for areas graded under Phase 1B drawings:

1. Subgrade and finish grade preparation shall be in accordance with site earthwork (Section 02220) and soil preparation requirements (Section 02911) and the drawings.

2. Prior to seeding, repair any ruts, rills, or gullies greater than 2 inches in depth to create smooth continuous grades.

4. If the prepared grade is eroded or compacted by rainfall or other reasons, rework the topsoil to the full topsoil depth.

4. Immediately before seeding, scarify, loosen, float and drag topsoil as necessary to bring it to the proper condition. Remove foreign matter larger than 1-inch diameter.

C. Site preparation for areas graded and temporary seeded under Phase 1A/1B drawings AND areas with existing vegetation not disturbed by grading activities, which is designated for replacement with upland native seed mixes:

1. Mow vegetation to 4 inches in height at 4-6 weeks before seeding. Cut material shall be removed from the site.

2. Ten days after mowing, spray vegetation with a broad spectrum, non-persistent glyphosate-based herbicide per manufacturer's instructions. Retreat vegetation with broad spectrum, non-persistent glyphosate-based herbicide after initial application if live vegetation persists. Weedy small woody plant material may require direct stump treatment.

3. Immediately before seeding, repair any ruts, rills, or gullies greater than 4 inches in depth to create smooth continuous grades.

4. Seeding or planting into the sprayed area should occur after time period specified by herbicide manufacturer.

D. Layout

1. All seeding zone boundaries shall be surveyed and staked on the project site by the Contractor, and shall extend to the limits of construction disturbance. No seed mix shall be installed until the grade preparation and layout have been approved by the ODNR Project Manager and RPR. Where edge of area planted with a Native Upland Seed Mix adjoins an area seeded with mown Turf Grass Seed, wood stakes painted with orange tips shall be placed at a minimum interval of 20-feet along the boundary to fully delineate the limits of the lawn mowing area (including trails) for establishment. These stakes shall remain in place for the entire native seed maintenance period, see Part 3.05. Replace stakes as necessary during the maintenance period.

2. The ODNR Project Manager or RPR reserves the right to adjust seed limits to meet field conditions without adjusting total seeded areas, at no additional cost to the Owner.

E. Method

1. For spring seeding, the area into which the seed mix will be installed should not have any standing plant material taller than 2". If plant material is taller than this height, the area should be mowed as closely to the ground as possible and cut material removed. It is preferable that seed be sown directly into cut plant stubble where possible to limit erosion.

2. Drill Seeder or Drop Seeder/Spreader:
   a. For spring drill seeding, sow seed directly onto bare ground or ground where the previous year's plant stubble has been cut to 2" height; for spring drop seeding, cultivate the ground before installing seed mix.
   b. If the configuration of the area to be seeded allows, apply at ½ the specified seed rate and apply the second ½ in a perpendicular direction.

c. Check the equipment frequently to ensure the seed is dispersing evenly and is not clogging.
d. If the equipment is not equipped with a roller, pass over the seeded area with a roller to firm the seed into the soil.

3. Hand-broadcasting:
   a. Areas within the dripline of existing trees shall be hand seeded to avoid damage to tree roots.
   b. Sow seed directly onto bare ground or ground where the previous year's plant stubble has been cut to a 2 inch height.
   c. Increase the volume of the broadcasted seed mix by mixing it with an approved carrier. Acceptable carrier material includes moistened compost, peat moss, or coarse-grade vermiculite. Sand and sawdust are unacceptable carrier materials. Use one bushel basket of carrier per 1,000 square feet of area to be seeded (a bushel equals 8 gallons or 1.24 cubic feet).
   d. Divide the seed quantity for the area in half. Using half of the total seed mix, cross the entire area to be seeded, evenly spreading the seed. Walk perpendicular to the original seeding and evenly broadcast the second half of the seed mix.
   e. Light seeds, awned seeds, or bearded seeds tend to rise to the top of the spreader, therefore, mix seed accordingly as planting commences.
   f. Rake or drag the seed into the soil, but not more than 1/4-inch deep. Roll the area with a roller to firm the seed into the soil.

4. **Keep the topsoil moist (to a depth of 3 inches) for 3-4 weeks following seeding**; afterward, apply 1" water per week during the growing season if rain has not occurred for more than one week. Do not apply water with such a force as to disturb seed, seedlings, and/or topsoil, or that would run off soil surface.

F. Mulch

1. Spread straw mulch evenly at the rate of 2 tons per acre over the seeded upland areas where bare soil is exposed and no erosion mat is indicated. Place all mulch on given areas within 48 hours after seeding. A mechanical blower may be used to apply mulch material, provided the machine has been specifically designed and approved for this purpose. Anchor all mulch using a light serrated disc. If a spraying tackifier is used, it may be applied either simultaneously or in a separate application. Apply tackifier over all mulched areas at a rate recommended by manufacturer for steep slopes (4:1 or greater).

3.03 EROSION MAT

A. Install erosion control mat as indicated in details on the Drawings on all areas specified to receive it. Native seed shall be installed prior to mat installation.

B. Reseed all disturbed edges immediately following mat installation and work seed into mat.

3.04 CLEANING, REMOVAL, AND RESTORATION

A. All areas over which hauling operations have been conducted shall be kept clean on a daily basis. Promptly remove all materials spilled on pavement.

B. Upon completion of seed installation, remove from the site and legally dispose of all trash and debris including any material removed during grade preparation.

C. Restore existing adjacent areas damaged by operations under the contract. Restoration shall include finish grading and seeding as required to match existing grade, and maintenance of restored areas.

D. Any damage by the Contractor to any established or newly seeded areas not within the project scope of work shall be repaired and reseeded at no cost to the Owner.

3.05 MAINTENANCE

A. General maintenance for all seed mixes:
   1. Site visits shall occur monthly during the first growing season to assess site conditions and correct issues with erosion and weeds. Reports documenting these monthly visits and any completed maintenance activities shall be submitted to ODNR Project Manager within two weeks following the visit.

   2. After spring installation, seeded areas shall be inspected with the ODNR Project Manager in attendance twice during the first growing season: once in early summer and once in early fall. Notify the ODNR Project Manager of the inspection no less than 2 weeks prior to an inspection. A report of the findings will be issued by the Maintenance Provider including agreed upon maintenance required.

   3. Any bare spots greater than 5 square feet shall be reseeded in accordance with the original specifications.

   4. Do not hand-pull large weeds during the first year following seeding because such action could disrupt small native seedlings.

   5. Weeds shall be spot treated during the first year of establishment with an appropriate herbicide, which must be executed by a certified pesticide applicator using the wick or soaked-glove methods only. Follow all manufacturer label directions, including timing, mixing, application, and clean-up. Spraying herbicide is not allowed at any time in the native seeded areas.

B. Mowing:
   1. During the first growing season following seeding, mow the native upland seeded areas each time (up to 4 times) that the plant material (annual and perennial weeds) has reached a height of 12-16 inches tall. Mow to a height of 6 inches. A flail-type mower that will finely shred mowed clippings must be used. Alternatively, a string trimmer may be utilized but all clippings and seed heads must be removed from the site following cutting.

3.06 ACCEPTANCE

A. Substantial Completion for entire site will be granted upon the successful completion of all seeding and verification by the ODNR Project Manager and RPR that all work has been installed in accordance with the plans and specifications. Following Native Upland Seed Mix installation, the ODNR Project Manager, RPR and Contractor shall conduct a Substantial Completion Inspection on all seeded areas. Following this inspection, re-topsoil, reseed, mulch, and re-apply erosion control blankets or turf reinforcement matting as directed by the RPR. Bare spots greater than 5 square feet shall be reseeded in accordance with the original specifications. All repairs shall be completed within one week following the inspection. All reseeding shall occur at no additional cost to the Owner.

B. Final Acceptance will be granted one full growing season following installation of the native upland seed mixes dependent on achieving specification requirements. Final Acceptance will

be granted if the seeded area shows an even distribution and germination of specified native plants and cover crop across the project site. All maintenance reports required in Part 1.02 shall have been submitted throughout the maintenance period. There shall be clear evidence that the specified maintenance mowing has occurred to control weed species. Failure to meet the requirement (weed-free seed beds) shall result in the Contractor extending the maintenance period until the specified cover is achieved at no additional cost to the Owner.

END OF SECTION

SECTION 02930
PLANTING

PART ONE - GENERAL

1.01 SUMMARY

A. Section Includes: Supply, installation, warranty and maintenance of plant material and goose grid fencing as indicated on drawings and specified herein.

1.02 SUBMITTALS

A. Samples: Provide the ODNR Project Manager and RPR samples of the following materials from the supply source being proposed:

1. Plant material: Sources and nursery purchase order agreements for each specified plant, including quantity, size, and quality. Inspection and tagging may be completed by the RPR at his/her discretion. In addition, plant samples or digital photos of plants may be requested in lieu of inspection.

2. Mulch: 1-quart volume of mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

3. One staple for use with aquatic plantings.

4. Goose grid: 6”x6” sample of perimeter fence material and product data sheet.

B. Test Report: Submit to the ODNR Project Manager and RPR two copies each of certified test reports for:

1. Topsoil (see Section 02911).

C. Contractor Qualifications

1. Documentation: List projects of similar scope, and type. Contractor must provide references for at least three projects of similar size and scope as wetland plug planting (2 acre minimum installation) performed within the past five (5) years. ODNR reserves the right to contact any and all references to obtain, without limitation, Contractor’s performance on the listed projects.

Information provided for each project shall include:

a) Project Name and Acreage
b) Client / Agency / Department / Office for Which Performed
c) Project Completion Date
d) Owner’s Project Manager or Other Representative
e) Current Client Contact Person / Phone Number / Email Address
f) Dollar Value of Contract

D. Certification

1. Phytosanitary certification: Plant material Inspection Certificates required by federal, state or other governing authority shall be submitted to the ODNR Project Manager upon delivery of each shipment.

2. Invoice: Submit vendor invoice or bill of lading for each plant shipment showing sizes, quantities and root treatment.

E. Construction Schedule: Upon Notice to Proceed with the work, submit construction schedule indicating dates for the items of work, shown herein in Part 1.05F.

F. Irrigation Plan: Per Part 3.05 of this Specification.

G. Maintenance Instructions: Prior to the issuance of the Notice of Substantial Completion, submit52-week maintenance schedule for all landscape maintenance activities identified under Part 3.05 of this Specification. The schedule shall be comprehensive and shall be the basis for monthly payment during the maintenance period.

H. Submit Maintenance Report Forms immediately following completion of each maintenance visit for items outlined in Part 3.05 of this Section. The form shall cross-reference the maintenance schedule. Payment for maintenance visits will not be made without submission of report forms.

I. Toxic Chemicals: Submit products, application rates, and anticipated uses of pesticides, herbicides, fumigants, etc.

1.03 QUALITY ASSURANCE

A. Qualifications

1. The work of this section shall be performed by a company specializing in landscape installation, having a minimum of 5 years' experience in projects of the scope and scale being specified, particularly in planting of wetland plug material.

2. Installer shall maintain an experienced full-time supervisor on project site when work is in progress.

B. All materials and work shall comply with applicable sections of the following references:

1. American Association of Nurserymen, Inc. (AAN) Standard: American Standard for Nursery Stock (ANSI Z60.1 – current edition), except where amended under this specification.

2. Hortus Third, Cornell University, 1976

C. Source Quality Control

1. Certification: All plant materials shall be inspected and certified by authorized governmental agencies and shall comply with regulations prevailing at both the source and the project site.

2. Plant material selection: Tag and request plant material inspection and approval by the RPR at least four weeks prior to digging.

3. Analysis and standards: Products in sealed containers shall be labeled with manufacturer's certified analysis. Bulk materials shall be tested by an approved laboratory in accordance with Association of Official Agricultural Chemists procedures, or as specified by product specifications referenced herein.

D. Substitutions

1. If specified landscape material cannot be located, Contractor shall submit a request to the RPR to identify alternate sources or substitutions. Plants of larger size may be used if approved and if root balls meet AAN standards for the increased size. Adjustments will be made at no additional cost to the Owner, except if downsized, credits to the Owner will be based on comparable industry costs.

2. Container plants may be substituted for those designated "B&B" if approved by the RPR in advance of order.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General

1. Packaged Materials: Deliver packaged materials in unopened containers showing weight, analysis and name of manufacturer, and indication of compliance with state and Federal laws if applicable. During shipment and storage on site, protect materials from breakage, moisture, heat or other damage.

2. Bulk Materials:
   a. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   b. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   c. Accompany each delivery of bulk materials with appropriate certificates.

3. Store materials only in locations approved by the ODNR Project Manager.

B. Plant Materials

1. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling. Schedule shipping to minimize on-site storage of plants. Stock shall not be shipped until the planting preparations have been completed.

2. Schedule shipping of wetland emergent plugs to result in on-site storage time of less than 24 hours prior to installation. If delays beyond the contractor's control occur after delivery, store plants to ensure viability. Storage procedures may include opening of plant containers and storage of rootstocks in water.

3. Once on site, keep plants watered and protected from sun, wind and mechanical damage; cover root balls with topsoil or mulch. Emergent plugs shall be stored in a cool place with ample moisture to maintain the plants in their natural wet habitat condition.

4. Handle plants at all times in accordance with the best horticultural practices. Lift B&B materials from the bottom of the ball only. Plants handled otherwise will be subject to rejection. Balled and burlapped plants which have cracked or broken balls are not acceptable and shall not be planted. Plants with mechanical damage, deformation or breakage will not be accepted and are to be replaced at the Contractor's expense.

1.05 SITE CONDITIONS

A. General

1. Prior to beginning work, examine and verify the acceptability of the project site and notify the ODNR Project Manager of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected or resolved.

2. Where planting occurs in close proximity to other site improvements, provide adequate protection to all features prior to commencing work. Promptly repair any items damaged during planting operations to their original condition.

B. Utilities: Have all underground utilities located by servicing agencies. In the vicinity of utilities, hand-excavate to minimize possibility of damage.

C. An on-site source of water will be available based on pumping water from the lake. Confirm water source prior to commencing work.

D. Planting Season

1. Materials shall be installed during planting seasons normally recognized in the job locality.

2. Spring Planting: Trees, shrubs, perennials and ornamental grasses shall be installed between April 1 and June 15. Restoration-grade bare root trees and shrubs shall be installed as a dormant season planting ONLY between March 15 and May 1, before new growth emerges on the plant material. Emergent plug plantings shall be installed ONLY between May 1 and May 31. Some emergent plugs are only available at certain times; the Contractor is responsible for determining availability of each aquatic plant species and scheduling the timing of installation to avoid delays. Plugs shall be installed as soon as weather permits to allow plantings to heal in prior to lake levels returning to normal conditions following the end of the drawdown period for construction. Plugs shall be kept in a moist soil condition per Part 3.05, Maintenance.

3. Fall Planting: Trees, shrubs, perennials, and ornamental grasses shall be installed between September 1 and October 30.

4. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements

5. If special circumstances warrant installation outside the normal planting season, submit a written request to the ODNR Project Manager describing conditions and stating the proposed variance. Planting outside the planting season does not alter warranty obligations.

E. Pesticides/Herbicides

1. Mixing or disposal of chemicals will not be permitted on site. Notify the Owner at least 24 hours prior to any application. Post all pesticide and/or herbicide applications.

F. Work Schedule

1. Upon authorization to proceed with the work, submit a project work schedule indicating the dates of each of the following items:
    a. Tagging of plants in nurseries
    b. Delivery of other materials to the site
    c. Staking of plant locations on the site
    d. Delivery of plant material to the site
    e. Planting
    f. Substantial completion of the work.

2. Update schedule at least monthly to reflect progress of the work.

G. Coordination with Other Work

1. The Contractor shall coordinate his/her work with other contractors or trades to determine the appropriate sequence of landscape installation with respect to other work on the site.

2. Work installed out of construction sequence which is disturbed by the completion of work by other trades shall be repaired at no cost to the Owner.

3. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.

4. Coordination with Seeding: Plant trees and shrubs after finish grades are established and <u>before</u> planting native seed or lawn unless otherwise indicated. Plant wetland and perennial plugs <u>after</u> installation of native seed and erosion mat (if present). If planting trees, shrubs, and other plants after installing seed, protect seeded areas, and promptly repair damage caused by planting operations.

1.06 ACCEPTANCE

A. Inspections for Acceptance of Work

1. Substantial Completion: Notify the ODNR Project Manager and RPR in writing when entire project planting operations are complete. Within 10 days after notification, the ODNR Project Manager and RPR will inspect the work and prepare a Notice of Substantial Completion, along with a punchlist of items that require completion or correction. Issuance of the Notice of Substantial Completion shall constitute the start of the warranty period for portion accepted.

2. Final Acceptance: Inspection will be made by the Contractor, ODNR Project Manager and RPR once all the terms of the warranty have been met and the site shall be in the condition stipulated under Part 3.03, Clean-Up.

   Final Acceptance inspection of plantings or material planted during recognized planting seasons will be made during the following June for spring plantings and the following late August / early September for fall plantings. Exception: Restoration-grade plant material installed as a dormant bare root spring planting shall be inspected in August of the year of installation, in order to determine replacements to be made during the following spring dormant planting season. Any bare root replacements will be inspected to verify leaf-out in June following the repair.

   Final Acceptance will occur at the end of the warranty period only after all punchlist items have been satisfactorily completed.

1.07 GUARANTEE

A. General

1. Warrant all plant material to be true to botanical name and specified size.

2. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period. Failures include, but are not limited to, the following:
   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
   b. Structural failures including plantings falling or blowing over.

3. Warranty Periods: After receiving a Notice of Substantial Completion (defined in Part 1.06), the warranty for providing replacement plants shall extend until June 30 for spring plantings and September 15 for fall plantings, after the end of one full growing season.

B. Replacements:

1. During the warranty period, replace, at no additional cost to the Owner, plants that are damaged, dead, or, in the opinion of the RPR, are unhealthy, or have lost their natural shape due to dead branches, excessive pruning or improper maintenance. Rejected plant materials shall be removed from the site and legally disposed of as they are

identified. Only one replacement of any plant is required after Substantial Completion, except for losses due to failure to comply with specified requirements.

2. Restoration-grade, bare root plant material installed as a dormant bare root spring planting shall be evaluated separately from other plant material. For this material, a minimum of 80% of the quantity of each planted species shall be in healthy condition, per the opinion of the RPR. For any species not meeting this performance standard, the Contractor shall provide replacements as follows, to allow for some future loss of the replacements:
    a. For species with a 50-79% rate of survival, replace a quantity sufficient to bring the total number of living plants to 90% of the originally specified quantity.
    b. For species with a 0-49% rate of survival, replace a quantity sufficient to bring the total number of living plants to 100% of the originally specified quantity.

3. Make replacements in accordance with the original specifications, no later than the next succeeding planting season. Fully restore areas damaged by replacement operations to their original and specified condition.

4. If, in the opinion of the ODNR Project Manager and RPR, it is advisable to extend the period of establishment for a second growing season, an inspection at the end of this extended period will be made to determine acceptability of the items involved. Improper planting and/or failure to conduct the year 1 maintenance in accordance with contract requirements shall be the basis for extending the period of establishment for a second growing season. This extended period shall not be paid for separately.

PART TWO - MATERIALS

2.01 MATERIALS

A. Plant Materials

1. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
    a. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
    b. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

3. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

4. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

5. Containers shall be finished landscape grade material having their roots well established in the soil mass. Plants over-established in the container, as evidenced by pot-bound root ends, will not be accepted.

6. Restoration-grade bare root plants shall be finished landscape grade material having a well-branched fibrous root system characteristic of the species. Roots are to be kept continuously moist with wet straw, moss, or other materials. Remove broken and injured roots prior to planting.

7. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

B. Topsoil: See Section 02911, Topsoil.

C. Mulches

1. Organic mulch shall be well-composted, finely shredded processed hardwood bark, free from foreign material and fragments in excess of 2 inches in any dimension. Color shall be natural (NO DYE).

D. Herbicide products and rates of application to conform with registered uses.

E. Staple for Emergent Plugs: Steel U-shaped anchor pin, 8” length.

2.02 SOIL MIXES

A. Standard planting backfill shall be excavated soil and/or topsoil for general site use.

2.03 GOOSE GRID FENCING

A. Perimeter fence: 2x2x6 hardwood stakes supporting black polyethylene poultry net, ¾”x1” mesh size. Fence shall be Tenax Cintoflex M or approved equal.

B. Exclusion string: 25-pound fishing monofilament flagged with red or orange survey ribbon.

PART THREE - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by ODNR Project Manager and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

C. Accurately layout plant locations or outline areas for multiple plantings according to the drawings using labeled lath. Prior to installation, all locations must be approved by the RPR, who may field adjust locations at no additional cost to Owner. If layouts are not understood or if surface or subsurface obstructions are encountered that are not indicated, do not proceed with planting operations until alternative plant locations have been selected and approved in writing by the RPR.

3.03 PLANTING

A. Excavation for Trees and Shrubs

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped, container-grown, or fabric bag-grown stock.
3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
7. Maintain supervision of excavations during working hours.
8. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
9. Backfill Soil: Subsoil and topsoil removed from excavations shall be used as backfill soil. Topsoil depth of 12" shall be maintained. Subsoil may be used as backfill below the topsoil layer.
10. Obstructions: Notify ODNR Project Manager if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
    a. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

B. Tree and Shrub Planting

1. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

2. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

   a. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
      i. Backfill: Use excavated soil for backfill, as provided under ‘Excavation for Trees and Shrubs,” above.
      ii. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
      iii. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
      iv. Continue backfilling process. Water again after placing and tamping final layer of soil.

   b. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
      i. Backfill: Planting soil Use excavated soil for backfill, as provided under ‘Excavation for Trees and Shrubs,” above.
      ii. Remove containers and make at least five vertical cuts one-half to one inch deep around the root ball and thoroughly loosen the roots on the outside of the ball.
      iii. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
      iv. Continue backfilling process. Water again after placing and tamping final layer of soil.

   c. Fabric Bag-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
      i. Backfill: Use excavated soil for backfill, as provided under ‘Excavation for Trees and Shrubs,” above.
      ii. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
      iii. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

iv. Continue backfilling process. Water again after placing and tamping final layer of soil.

d. Restoration-Grade Bare Root Stock:
   i. Backfill: Use excavated soil for backfill, as provided under 'Excavation for Trees and Shrubs," above.
   ii. Prior to planting, remove damaged roots and those running beyond the general root mass. Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades. Arrange roots in a natural position, uniformly distributed around the crown of the plant.
   iii. Carefully work soil backfill in and around the roots in several layers, watering until puddled and allowing the soil to settle between layers. Maintain plumb while working backfill around roots, and complete planting as described for container-grown plants, above.
   iv. Protect bare root stock as necessary from animal predation. Flag or otherwise mark locations of all bare root stock material for protection during native seed maintenance activities.
   v. Mulch is not required for bare root material.

e. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

C. Ornamental Grass / Perennial Container Planting

1. Set out and space ornamental grasses and perennials as indicated on Drawings in even rows with triangular spacing.

2. Dig holes large enough to allow spreading of roots.

3. Using topsoil for backfill, work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

4. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

D. Perennial Plug Planting

1. Install seed as per Drawings prior to any plug planting.

2. Set out and space Perennial Plugs 18 inches apart as indicated on Drawings in a naturalized manner with triangular spacing.

3. Prior to planting, biodegradable plant containers shall be split and non-biodegradable containers removed. The root systems of all such plants shall be split or crumbled by hand.

4. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

5. Do not mulch plugs planted within seeded areas.

E. Emergent Plug Planting

1. Install seed and erosion control mat as per Drawings prior to any plug planting.

2. Set out and space Emergent Plugs 18 inches apart as indicated on Drawings in even rows with triangular spacing.

3. Prior to planting, biodegradable plant containers shall be split and non-biodegradable containers removed. The root systems of all such plants shall be split or crumbled by hand.

4. To install plugs into erosion control mat, cut 'X' into the erosion control mat, pull back corners and excavate hole 2x width of plug and same depth as plug. Install and backfill with topsoil, folding fabric under to hold open at sides of plug plant foliage.

5. For staple planting where indicated, work each plug or rootstock into the soil up to the shoot collar of the plant. Do not bury the entire plant or damage sprouted vegetation. After planting, anchor in the soil using metal staple as shown on the detail. Do not puncture plant tissue.

6. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

7. Do not mulch plugs planted within seeded areas.

8. Replant any plugs that become dislodged or float after planting. The Contractor shall inspect the planting at least once every other day during the first 10 days after installation to verify conditions.

9. Goose Grid Installation:
   a. Immediately following completion of plug planting, install goose grid to prevent predation of aquatic plants in locations shown on Drawings.
   b. Install 2x2x6 hardwood stakes driven 2.5' into the soil at 10' on center around the perimeter of the planted areas.
   c. Using 25-pound fishing monofilament, firmly connect the monofilament to posts on opposite sides of the planting area via wrapping, stretching, and tying. Avoid parallel lines. Overlap and criss-cross as much as possible until each post has at least one attached line. Line shall be suspended 30-36" above the normal water surface elevation. Attach 24" long red or orange survey ribbon to the strings every 24" apart.
   d. Install perimeter polyethylene fence tight against the hardwood stakes.
   e. Maintain monofilament in a tight condition until the end of the planting warranty. At that time, the entire goose grid system shall be removed and disposed of by Contractor.

D. Mulching

1. Uniformly install mulch on all trees, shrub and ornamental grass beds as shown on plans. Apply mulch only after planting installation has been approved by the RPR.

2. Keep mulch out of the crowns of shrubs and at least 3" from all tree trunks.

E. Pruning

1. After planting, prune trees to remove all dead wood, crossed limbs, and other limbs necessary to promote the symmetrical growth of the plant. On shrubs, remove all dead wood and broken branches. Do not use hedge shears. Retain natural form of the plant type. Remove trimmings from the site.

2. Employ workers experienced in this type of work.

3.04 CLEAN-UP

A. Remove excess and waste material daily. When planting has been completed, clear the site of all debris, stockpiles and materials.

B. Repair any damage to existing landscape, paving or other such features as a result of work related to this contract to its original condition.

C. Protect landscape work and materials from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

3.05 MAINTENANCE

A. Provide all equipment, materials, labor and services to maintain the landscape beginning immediately after each plant is installed and continuing until Final Acceptance at the end of the warranty period. Perform all work under the direct supervision of a technician trained to recognize and treat conditions affecting the established and growth of the plants.

1. Inspect plants at least once biweekly and perform needed maintenance promptly.

2. Provide an approved temporary irrigation system or hand water from a source approved by the ODNR Project Manager. Emergent plug plantings shall be watered with a temporary irrigation system utilizing the lake as the water source. The system shall have the ability to be operated without moving hoses or sprinklers around the site between seeded/planted areas (i.e. system can be set to water one area for the required maintenance period), and may be automated with a timer. Submit irrigation plan and schedule for approval prior to landscape installation. The soil of the wetland emergent plug planting zones shall be kept moist to a depth of three inches throughout the first growing season. Irrigate the remainder of the plant material to maintain optimum moisture within the root zone (minimum once per week); reoccurring overly dry or wet conditions according to species shall be grounds for rejection of plant material. Do not apply water with a force that displaces mulch or causes soil erosion.

3. Prune dead wood and broken limbs as identified, in accordance with 3.03E, above.

4. Maintain all plant beds and tree saucers weed free. Hook mulch monthly and add mulch as needed.

5. Keep plants free of insects and disease. Apply pesticides and herbicides as required, using integrated pest management practices, to control specific pests. Apply when

areas are clear of pedestrians and automobiles. Notify Owner at least 24 hours prior to application and post all applications as completed. No mixing or disposal of pesticides or herbicides is allowed on site.

6. Remove dead and unacceptable plants as their condition becomes apparent.

B. At the end of the warranty period but prior to Final Inspection, re-mulch tree rings and beds as originally specified.

END OF SECTION

SECTION 03121
FORM LINERS FOR ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes form liners for texturing architectural concrete, including all accessories as required.

1.02 RELATED SECTIONS

A. Section 03300: Cast-In-Place Concrete

1.03 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 117 - Standard Tolerances for Concrete Construction and Materials.
2. ACI 301 - CH. 13, Specifications for Structural Concrete.
3. ACI 303R-91 - Guide to Cast-in-Place Architectural Concrete.
4. ACI 309 72 [78] - CH. 7, Recommended Practice for Consolidation of Concrete.
5. ACI 347 78 - CH. 5.2, Recommended Practice for Concrete Formwork.

1.04 SUBMITTALS

A. Product Data: Installation instructions and Product Data verifying compliance with specifications.

B. Shop Drawings: Form liner layout and termination details. Indicate backup, rustication, reveal, and chamfer strip locations. Include jointing, form tie location and pattern of placement.

C. Samples: 24 inch by 24 inch of each pattern scheduled or required.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A minimum of 3 years manufacturing experience with form liners similar to those required for this Project.

B. Installer Qualifications: A minimum of 3 years experience with form liners similar to those required for this Project.

C. Architect/Engineer's review for aesthetic criteria.

D. Contractor shall be responsible for design of formwork and back-up of form liner for structural stability and sufficiency.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Provide full scale, vertical wall mock-up (minimum 8’ x 10’) using contract materials, methods and workmanship. Include wall corner treatment. Incorporate formwork accessories and minimum one vertical and one horizontal form liner joint. Include concrete mix, forming system, form release agents, placement rate,

form pressures, joint sealing, vibrating and stripping practices. Demonstrate patching and repair procedures for spawled concrete, and voids caused by honeycombing or bug holes.

2. Approved mock-up shall be the standard by which Work will be evaluated. The sample shall not be part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Cover form liners to protect from oil, dirt and UV exposure.

B. Do not use damaged products. Do not install products not bearing product trade name and manufacturer's name.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Form liner as provided by Dayton Superior, 1125 Byers Road, Miamisburg, OH 45342, (800)745-3700, www.daytonsuperior.com, or approved equivalent.

1. Stone pattern: Colonial Dry Stack

2.02 ACCESSORIES

A. Form release agent: As recommended by selected manufacturer.

B. Stain: stain to be supplied to match limestone site walls and approved by Project representative.

PART 3 - EXECUTION

3.01 FORM LINER PREPARATION

A. Verify lines and levels of formwork and form liner patterns are within allowable tolerances.

B. On multiple use liners, clean liner before each use. Do not use damaged liner when continued use or repair would diminish the aesthetics of the Work.

C. Apply release agent according to manufacturer's directions. Schedule concrete pour immediately after application of release agent to avoid precipitation, dust, and debris. Protect reinforcing steel from exposure to release agents.

3.02 FORM LINER INSTALLATION

A. Store and use form liner panels at temperatures between 40 - 140 degrees F.

B. Apply foam tape to plate or sill supporting formwork to prevent leakage at base of plastic

form liner.

C. Assemble and brace the architectural side of the formwork first; attach form liner before setting ties or opposite formwork side.

D. Apply foam tape to back side of form liner along all edges; allow foam tape to extend beyond the edge when the form liner will be jointed.

E. Work with one sheet at a time; position form liner against formwork so that edges, pattern, and joints are square.

F. Staple form liner on 3 inch centers and around all tie locations. Drive staple heads flush with surface.

G. Position foam tape behind the joint of two pieces and press down firmly.

H. Insert grout seal blocks as required to seal tie holes, fill voids in boxouts, and open-ended patterns, or support especially deep patterns.

3.03 CONCRETE PLACEMENT

A. Place concrete using a pump or conveyor with drop chute to avoid segregation. Place in 2 foot lifts and do not move material horizontally as movement may result in visible flow lines in the surface.

B. Thoroughly vibrate concrete to achieve consolidation, and minimize voids. Internally vibrate into previous lift to avoid lift lines. Avoid vibrator contact with the form liner.

3.04 FORM LINER ACCESSORY INSTALLATION

A. Place rustication lines located as indicated within acceptable industry tolerances.

B. Form corners indicated to be chamfered with PVC chamfer. Chamfered corners shall be smooth, solid, unbroken continuous lines.

3.05 FORM LINER MAINTENANCE

A. Proper cleaning and storage of form liner is required to obtain acceptable results. Prevent matrix build-up on the liner surface. Scrub the liner surface with a stiff bristle scrub brush dipped repeatedly in one of the approved release agents. All excess release agent shall be blown or wiped off before the form and liner is put back into service.

B. Storage of form liner shall be out of direct sunlight and in temperatures below 140 degrees F. Store flat (not rolled).

END OF SECTION

SECTION 03250
IN-STREAM BANK TREATMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Furnishing, installation, and protection of in-stream practices to stabilize and restore eroding streambanks and protect from erosion at storm sewer outfalls.

1.02 REFERENCES

A. Ohio Stream Management Guides, Ohio Department of Natural Resources, Division of Soil and Water Resources (http://www.dnr.state.oh.us/water/pubs/fs_st/streamfs/tabid/4178/Default.aspx)

B. USDA, Natural Resources Conservation Service, Stream Restoration Design, Streambank Soil Bioengineering, "Technical Supplement 14I, Part 654, National Engineering Handbook. http://directives.sc.egov.usda.gov/viewerFS.aspx?hid=21433

C. Ohio Department of Transportation Construction and Materials Standards, latest edition, as referred to herein as ODOT.

1.03 SUBMITTALS

A. The Contractor shall provide manufacturer's specifications for materials used to implement the erosion control plan including but not limited to the following:
   1 Geotextile Fabric
   2 Stone Sources, Sizes, and Gradations
   3 Provide stone samples for verification of stone required.
   4 Erosion Control and Turf Reinforcement Mats

PART 2 - PRODUCTS

2.01 STONE FOR STREAMBANK PROTECTION

A. General

1. All stone shall be highly resistant to weathering and disintegration under freezing and thawing, and wetting and drying conditions, and shall be of a quality to ensure permanence of the structure in the climate in which it is to be used. The stone shall be durable, sound, and free from detrimental cracks, seams and other defects which tend to increase deterioration from natural causes or cause breakage in handling and/or placing.

2. Do not place material without approval of the stone quality, size, and shape by the ODNR Project Manager.

B. Gradation

1. Stone for Footer Rock (J-Hooks and Cross-Vanes)

a. Stone used for in-stream structures such as J-hooks and cross vanes shall be boulders of relatively uniform size and shape, rounded or angular, with no dimension that is greater than two times the smallest dimension.

b. Footer Rocks shall be equal to or larger than the top layer of stone, but no greater than 20 inches in any dimension.

c. The top layer of stone used for in-stream structures shall have an average diameter of 10 to 15 inches.

2. Soil/Cobble Mixture for Streambed

a. Streambed cobble stone shall be sourced from salvaged shale cobble from the existing reservoir shoreline in areas that are being excavated.

3. Rip Rap

a. Rip Rap shall be Dumped Rock Fill, meeting requirements of Item 703.19 of the ODOT Specifications. . Broken concrete shall not be used. Rip rap material shall be stone, quarried from undisturbed, consolidated deposits (ledges) of rock reasonably free of shale and shaly stone. The ledges shall be sufficiently thick to produce the desired dimensions. The stone shall be reasonably free of laminations, seams, cracks, and other structural defects or imperfections tending to destroy its resistance to weather.

b. Rip Rap sizes shall conform to Types A -D as shown on drawings and specified in Item 703.19B of the ODOT Specifications.

2.02 EROSION CONTROL AND TURF REINFORCEMENT MAT

A. General

Erosion Mat Products shall comply with requirements in Section 02200 – Soil Erosion and Sedimentation Control.

PART 3 - EXECUTION

3.01 GENERAL

A. Pre-Construction Layout

Prior to vegetation removal or disturbance of the streambed and banks, the Contractor shall pre-stake the alignment of the channel and plan location of proposed in-stream stabilization measures for review by the ODNR Project Manager. The Contractor shall notify the ODNR Project Manager at least 7 days prior to the proposed in-stream disturbance so that ODNR Project Manager can review the layout and evaluate the need for modifications. Modifications may include onsite adjustments to the design based on constraints that may not have been included in the original design survey. Terrain irregularities, vegetation, and channel changes since the field data were collected may all necessitate local modifications to placement. All temporary and permanent staging areas for materials, stockpile areas, vegetative donor sites, and boundary references/ must be approved by ODNR Project Manager prior to their use.

3.02 RIP RAP

A. Subgrade Preparation

The subgrade surfaces on which the riprap or bedding course is to be placed shall be cut or filled and graded to the lines and grades shown on the construction details. When fill to subgrade lines is required, it shall consist of approved materials and shall be compacted to a density equal to the adjacent existing soil material. Rock materials shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the Owner or Owner's Representative. Cut keyway at base of slope to reinforce the toe; keyway depth should be 1½ times the design thickness of the riprap and extend a horizontal distance equal to the design thickness. Place geotextile fabric in accordance with Section 3.01A.

B. Equipment Placed Stone

The rock shall be placed by equipment on the surfaces and to the depths specified. The riprap shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact, one to another with the smaller rocks and spalls filling the voids between the larger rocks. Rock shall be placed in a manner to prevent damage to the underlying geotextile fabric or adjacent structures.

3.03 J-HOOK AND CROSS VANES

A. General

1. J-Hook Vane Description

The J-Hook Vane is an upstream directed, gently sloping structure composed of natural stone. The structure is comprised of Vane Rock placed on Footer Rock and is located on the outside of stream bends. The vane portion of the structure occupies 1/3 of the bankfull width of the channel, while the "hook" occupies the center 1/3.

2. Cross Vane Description

   The Cross Vane is an upstream directed, gently sloping structure composed of natural materials. The structure is comprised of Vane Rock placed on Footer Rock and is located at stream locations necessary to create habitat or grade control. The vane portions of the structure occupies 1/3 of the bankfull width on either side of the channel, while the "hook" occupies the center 1/3.

B. Vane angle. The vane arm portion of J-Hooks and Cross Vanes shall be 20-30 degrees measured upstream from the tangent line where the vane intercepts the bank.

C. Vane slope. The slope of the vane extending from the bankfull stage bank should vary between 2-7 percent. Vane slope is defined by the ratio of bank height/vane length.

D. Bank height. Cross Vanes and J-Hooks shall only extend to the bankfull stage elevation. If the bank is higher, a bankfull bench is constructed adjacent to the higher bank and the structure is integrated into the bench.

E. Footers. All Vane Rocks for J-Hooks and Cross Vanes require Footer Rocks. The minimum footer depth at the invert shall be approximately 3 times the protrusion height of the invert rock.

3.04 EROSION CONTROL MAT AND TURF REINFORCEMENT MAT FOR BANK PROTECTION

A. Install in accordance with Section 02200 - Soil Erosion and Sedimentation Control.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Foundation walls.
2. Slabs-on-grade.
3. Site Structures.
4. Footings.

B. Related Sections:

Section 02220 "Site Earthwork".

Section 03310 "Concrete Paving" for concrete pavement and walks.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash and other pozzolans, subject to compliance with requirements.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

Indicate amounts of mixing water to be withheld for later addition at Project site.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer testing agency.

B. Material Certificates: For each of the following, signed by manufacturers:

Cementitious materials.

1. Admixtures.
2. Steel reinforcement and accessories.

C. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

ACI 301, "Specifications for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete."

1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Pre-installation Conference: Conduct conference at Project site.

Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

Formulate form-release agent with rust inhibitor for steel form-facing materials.

B. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

1. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

Portland Cement: ASTM C 150, Type I, Grey

B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

Maximum Coarse-Aggregate Size: 1 inch nominal.

1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

2.06 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

a. Meadows, W. R., Inc.; EVAPRE.

b. Sika Corporation; SikaFilm.

B. Water: Potable.

2.07 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.08 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

2.09 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

Minimum Compressive Strength: 4000 psi at 28 days.

1. Maximum Water-Cementitious Materials Ratio: 0.45.

2. Slump Limit: 4 inches, plus or minus 1 inch.

3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

Minimum Compressive Strength: 4000 psi at 28 days.

1. Maximum Water-Cementitious Materials Ratio: 0.45.

2. Slump Limit: 4 inches, plus or minus 1 inch.

3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for nominal maximum aggregate size.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.

1. Minimum Cementitious Materials Content: 520 lb/cu. yd.
2. Maximum water to cement ratio: 0.45
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for nominal maximum aggregate size.

D. Site Structures: Proportion normal-weight concrete mixture as follows:

Minimum Compressive Strength: 4000 psi at 28 days.

1. Maximum Water-Cementitious Materials Ratio: 0.45.
2. Slump Limit: 4 inches, plus or minus 1 inch.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

B. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

Install keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Exterior corners and edges of permanently exposed concrete.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

1. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.05 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

1. Maintain reinforcement in position on chairs during concrete placement.

2. Screed slab surfaces with a straightedge and strike off to correct elevations.

3. Slope surfaces uniformly to drains where required.

4. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

1. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.07 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.08 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. Cure concrete according to ACI 308.1.

3.09 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

1. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

2. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless

of width, and other objectionable conditions.

1. After concrete has cured at least 14 days, correct high areas by grinding.
2. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
3. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

2. Air Content: ASTM C 231, pressure method, for normal-weight concrete; [ASTM C 173/C 173M, volumetric method, for structural lightweight concrete;]one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

3. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Compression Test Specimens: ASTM C 31/C 31M.

Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

a. Cast and field cure [two] <Insert number> sets of two standard cylinder specimens for each composite sample.

Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.

b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

5. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

6. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

7. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

8. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

9. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

10. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

C. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION

SECTION 03310
CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Walks.
2. Curbs and gutters.
3. Driveways

B. Related Sections:

Section 03300 "Cast-in-Place Concrete"

1. Section 3315 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Action Submittals:

Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified .

B. Material Certificates: For the following, from manufacturer:

Cementitious materials.

1. Steel reinforcement and reinforcement accessories.
2. Admixtures.
3. Curing compounds.
4. Bonding agent or epoxy adhesive.

C. Material Test Reports: For each of the following:

1. Aggregates.

1.06 QUALITY ASSURANCE

A. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

B. ACI Publications: Comply with ACI 301 unless otherwise indicated.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.

1. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from [as-drawn] [galvanized-]steel wire into flat sheets.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair l

2.02 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

Portland Cement: ASTM C 150, gray portland cement Type I .

B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source.

Maximum Coarse-Aggregate Size: 1 inch nominal.

1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

2.03 CURING MATERIALS

A. Water: Potable.

B. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

Meadows, W. R., Inc.; EVAPRE.

a. Sika Corporation, Inc.; SikaFilm.

White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.04 WHEEL STOPS

2.05 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

1. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

Compressive Strength (28 Days): 4000 psi .

1. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.

2. Slump Limit: 4 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.

2. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

3. Air Content: 6 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Cementitious Materials: Portland Cement

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.

1. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

Locate expansion joints at intervals of 50 feet unless otherwise indicated.

1. Extend joint fillers full width and depth of joint.
2. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
3. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
5. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating dowel joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

1. Do not use frozen materials or materials containing ice or snow.

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

B. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:

Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.

C. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:

Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

3.09 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

Elevation: 3/4 inch.

1. Thickness: Plus 3/8 inch, minus 1/4 inch.
2. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/2 inch.
3. Joint Spacing: 3 inches.

4. Contraction Joint Depth: Plus 1/4 inch, no minus.

5. Joint Width: Plus 1/8 inch, no minus.

3.11 WHEEL STOPS

A. Securely attach wheel stops to paving with not less than two steel dowels located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 03315
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

Cold-applied joint sealants.

1. Hot-applied joint sealants.

1.03 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of joint sealant and accessory, from manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.

1. When joint substrates are wet.
2. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
3. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.02 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.

Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.

Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

2.03 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.

Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

Crafco Inc., an ERGON company; Superseal 444/777.

a. Architect approved equal.

2.04 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:

Place joint sealants so they directly contact and fully wet joint substrates.

1. Completely fill recesses in each joint configuration.

2. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

D. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

Remove excess joint sealant from surfaces adjacent to joints.

1. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.04 CLEANING

A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 04720
CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-stone veneer.
2. Cast-stone trim.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast-stone units, include dimensions and finishes.

B. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

C. Samples:

1. For each color and texture of cast stone required.
2. For colored mortar.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.

PART 2 - PRODUCTS

2.1 CAST-STONE UNITS

A. Manufactures
1. Boral Stone Products LLC,
One Owens Corning Parkway

Toledo, OH 43659
Tel: (800) 255-1727
Fax: (419) 325-3995

2. Eldorado Stone Headquarters
1370 Grand Ave. Bldg B
San Marcos, CA 92078
Tel: (800) 925-1491
3. StoneCraft - Offered by Tapco,
29797 Beck Rd.
Wixom, MI 48393
Tel: 8885806448

B. Cast-Stone Units: Comply with ASTM C 1364.

1. Units shall be manufactured using the wet cast method.
2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

E. Colors and Textures: Match Architect's samples.

2.2 ACCESSORIES

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.3 MORTAR

A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.

1. For setting mortar, use Type N.
2. For pointing mortar, use Type N.

B. Pigmented Mortar: Use colored cement product.

2.4 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast-stone units according to ASTM C 1364.

1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine substrates upon which manufactured stone veneer will be installed.

C. Do not begin installation until backing structure is plumb, bearing surfaces are level and substrates are clean and properly prepared.

D. Verify that built-in items are in proper location, and ready for roughing into stone masonry.

3.2 PREPARATION FOR INSTALLATION OVER SHEATHING

A. Cover sheathing with moisture barrier with all joints lapped shingle style a minimum of 2 inches (52mm). Lap vertical joints a minimum 6 inches (152mm).

B. Install metal lath with small cups pointing upward. Apply metal lath taut, with long dimension perpendicular to supports. Lap ends minimum 1 inch (25mm). Secure end laps with tie wire where they occur between supports.

C. Attach metal lath to wood supports using galvanized nails or staples at maximum 6 inches (152mm) on center vertically and 16 inches (406 mm) on center horizontally. Fasten with a minimum of a 1 inch (25 mm) penetration of the wood studs. Overlap lath at inside and outside corners a minimum of 16 inches (406 mm).

3.3 SETTING CAST STONE IN MORTAR

A. Install cast-stone units to comply with requirements in Section 042000 "Unit Masonry."

B. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Fill dowel holes and anchor slots with mortar.
2. Fill collar joints solid as units are set.
3. Build concealed flashing into mortar joints as units are set.
4. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
5. Keep joints at shelf angles open to receive sealant.

C. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

D. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

E. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

F. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.

G. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04720

SECTION 04721
STONE VENEERED WALLS

PART ONE - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Stone veneer attached to concrete site walls with mortar.

1.02 REFERENCES

A. The work shall comply with the following:

ASTM C91 – Standard Specification for Masonry Cement.
ASTM C97 – Standard Specification for Absorption and Bulk Specific Gravity of Dimension Stone.
ASTM C99 – Standard Specification for Modulus of Rupture of Dimension Stone.
ASTM C144 – Aggregate for Masonry Mortar.
ASTM C150 – Standard Specification for Portland Cement.
ASTM C170 – Standard Specification for Compressive Strength of Dimension Stone.
ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.
ASTM C270 – Mortar for Unit Masonry.
ASTM C568 – Standard Specification for Limestone Dimension Stone.

1.03 QUALITY CONTROL

A. Samples

1. Furnish the following samples for approval prior to delivery of materials to the site: Stone veneer stone pieces in quantity to represent the full range of color and sizes required, including corner veneer.

2. Accessories – Each of the following proposed: Mortar and sealant product numbers and colors.

3. Construct an 8’x8’ sample of vertical concrete wall with stone veneer including corner pieces. Sample shall be representative of all materials and methods proposed. The sample will be examined by the Resident Project Representative (RPR). If the sample is not approved, corrections shall be made and the sample re-examined. Once the sample is approved, it shall be the standard to which all work must conform. The sample shall not be part of work.

B. Correction of Defective Work

1. Work determined to be defective by the RPR, regardless of all previous inspections, shall be corrected to the satisfaction of the RPR at no extra cost to the Owner.

1.04 PROJECT CONDITIONS

A. Examine work in place upon which this work is dependent. Defects which may influence satisfactory completion and performance of this work shall be corrected in accordance with the requirements of the applicable section of work prior to commencement of the work. Commencement shall be construed as work in place being acceptable for satisfying the requirements of this section.

1.05 DELIVERY AND STORAGE OF MATERIALS

A. Deliver mortar materials to the project site in their original unopened containers bearing label identifying manufacturer's name and brand, and store under cover in a dry place so as to prevent absorption of water or intrusion of foreign matter.

B. Store masonry units off the ground in a dry location, covered and protected from the elements, including rain, snow, and ice, and from damage.

C. Units shall be free from soil, ice and frost when erected.

PART TWO - PRODUCTS

2.01 STONE VENEER WALLS

A. Face Stone: Ashlar Thin Veneer.(or RPR approved equal)
B. Lengths: Range 4 to 14 inches.
C. Height: Range 3 to 7 inches.
D. Thickness: 1 ½ inches.
E. Color: Selection by RPR after review of samples.

2.02 MORTAR

A. Masonry Cement: Complying with ASTM C91, Type S, Color, gray.
B. Portland Cement: Complying with ASTM C150, Type 1, Color, gray.
C. Mortar Aggregate: Complying with ASTM C144, standard masonry type.
D. Hydrated Lime: Complying with ASTM C207, Type S.
E. Water: Clean and potable.

2.03 MIXES

A. Mortar Mixes: Mortar for Structural Masonry comply with ASTM C270. Mix only in quantities needed for immediate use. Do not use anti-freeze compounds to lower freezing point of mortar.

2.04 JOINT SEALANT

A. Sealant Materials: Single-component, elastomeric sealant complying with ASTM C920, Type S, Grade NS, Class 25, Uses NT, a silicone material.

B. Joint Cleaner: Provide type of substrate cleaning compound recommended by sealant manufacturer for substrate surfaces to be cleaned.

C. Sealant Warranty: Provide written warranty for period of five years after date of substantial completion, replace/repair defective materials and workmanship defined to include: instances of leakage of water or air; failures in joint general durability, failure to perform as required; and the general appearance of deterioration in any other manner not clearly specified in manufacturer's published product literature.

PART THREE – EXECUTION

3.01 GENERAL

A. Install thin veneer stone and mortar in accordance with ACI 530.1/ASCE 6/TMS 602 Specifications for Masonry Structures.

3.02 PROTECTON OF WORK

A. Brace or otherwise protect walls during erection as required to protect work from damage.

3.03 WORKMANSHIP

A. Lay masonry plumb in the thickness and pattern indicated, conforming to the approved sample.

B. Adjust each unit to its final position while the mortar is still soft and plastic.

C. Cutting of masonry shall be done with masonry saws.

3.04 CLEANING

A. Keep the face of stone free of mortar as the work progresses. If residual mortar is on the face of the stone, allow to dry partially and brush the mortar off the surface and sponge off the residue.

B. When the work is completed and the mortar has set for 2 to 3 days, the surface may be cleaned from top to bottom using a mild masonry detergent acceptable to the stone manufacturer. Do not use metal brushes or acids for cleaning.

END OF SECTION

SECTION 05115
STEEL PIPE PILES, MARINE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Steel pipe piles installed to depths specified on the Contract Drawings or, if required by the design of the contractor, to the additional depth required.

B. Related Section: SECTION 09900 PAINTS AND COATINGS

1.02 REFERENCES

A. ASTM International, as referenced herein as ASTM.

B. American Welding Society, as referenced herein as AWS.

1.03 SUBMITTALS

A. Source Quality Control:
   1. Shop Drawings:
      a. Submit Shop Drawing showing pile locations, including unique designation or number for each pile, details for piles and driving points.

      b. If field splices are expected, indicate splice location and details.

      c. Indicate welds by standard AWS symbols and show size, length and type of each weld.

   2. Mill Test Report:
      a. Submit certified copies of mill test report to the Testing Agency.

B. Field Quality Control:

   1. Submit a detailed procedure relating to pile driving operation prior to commencement of pile installation. Include details of pile hammer, power plant, leads, pile cushion and cap block.

   2. Submit a detailed procedure describing pile load test protocol. Include arrangement of pile reaction frame, test and anchor piles, equipment and instrumentation. Include current calibration reports for all test equipment for which calibration is required.

   3. Records:
      a. Submit complete record of each driven pile indicating driven length, rock elevation, rock socket embedded length, final elevation of tip and top, number of splices in casing and locations, blows required for each foot of penetration throughout the entire length and final 6 inches of penetration and the total driving time. Include records of any unusual conditions encountered during pile installation.

1.04 PROJECT CONDITIONS

A. Examine the site and become familiar with geological formation in the area of this project to ascertain the state and conditions under which the Work is to be done.

B. Logs of soil borings are included only as “Information to Bidders” and are not part of the Contract Documents. The data on indicated subsurface conditions is not intended as representation or warranties of accuracy or continuity between soil borings. Assume full responsibility for interpreting boring data and conclusion drawn from the information furnished and from the inspection at the site.

C. A geotechnical report has been prepared by CTL Engineering, Inc., dated February 29, 2012, is available for information purpose and may be examined at the Construction Manager's office during normal working hours. This report was prepared for design purposes only. Should the data contained in this report not be adequate for the contractor’s purposes, additional test borings and other exploratory operation may be performed at its expense with the approval of the Engineer and the Owner.

1.05 DELIVERY, STORAGE AND HANDLING

A. Materials ordered or delivered to Project site prior to verification of pile length, will be at Contractor's risk.

B. After pile lengths are verified, deliver materials to Project site to ensure continuity of pile driving operations.

C. Store piles in orderly groups and blocked to prevent distortion of members.

PART 2 - PRODUCTS

1.01 MATERIALS

A. General:
1. Provide steel pipe, driven in intimate contact with ground. Steel pipe piles shall be driven to the deeper (longer pile) limits of either the minimum pile tip elevation shown on the plans or the depth as required to establish five feet of rock socket embedment.

B. Steel Pipe Piles - ASTM A252, Grade 3, welded seamless new pipe, nominal diameter as indicated. Wall thickness as noted on the plans. Spiral pipe will not be allowed.

1.02 DRIVING AND BORING EQUIPMENT

A. Provide pile driving and boring equipment of type generally used in standard pile construction practice and of adequate size and capacity to permit pile driving at locations indicated and with required axial alignment.

B. Drive piles with a hammer operating in fixed leaders to hold hammer and pile in accurate alignment.

C. Drive piles with a steam-, air-, hydraulic- or diesel-powered hammer capable of consistently delivering driving energy to pile within the range recommended by hammer manufacturer.

D. Use cap block or hammer cushion made of solid wood or aluminum and micarta discs stacked alternately in steel housing with steel top and bottom plates capable of protecting the head of pile and minimizing energy absorption and dissipation.

1.03 FABRICATION

A. Fabricate full-length steel pipe piles by splicing lengths of pipe pile together, if required. Continuously weld steel pipe piles using full penetration butt welds as per AWS D1.1 using tight fitting inside standard back-up rings. Accurately align splices and limit number of splices to one per pile.

B. Fit and weld driving points to tip of pile according to manufacturer's written instructions and per AWS D1.1.

PART 3 - EXECUTION

1.01 PREPARATION

A. Protection:
1. Exercise extreme care in performing piling operations so as not to create excessive shock waves, vibrations of tremors which may cause damage to adjacent structures and property, underground structures, including sewers, and utilities.

1.02 PILE INSTALLATION

A. General:

1. Do not drive piles until earthwork in area in which piles are to be driven has been completed.

B. Pile Driving:
1. For driving, use the same type of pile hammer, operated at the same rate and in same manner.
2. Replace highly compressed, charred, burned or deteriorated pile cushion during piling operation.

C. Tolerances:
1. Maximum permissible horizontal variation of pile at cut-off location: 2 inches.

2. Maximum variation from vertical for plumb piles: 1 in 48 and allow for proper movement of the gangway and dock system for the full range of water levels and movement.

3. Maximum variation in pile casing cut-off elevation: 1 inch below.

4. Should the specified tolerance be exceeded and redesign indicates load on any pile exceeding 110% of design load, provide additional piles and pile caps to the extent deemed necessary by the Engineer to correct the condition. Provide additional engineering required to correct the error made at Contractor's expense.

D. Obstructions and Damaged Piles:
1. Should an obstruction be encountered below grade preventing placement of pile to required location or penetration, or cause the pile to drift from the required location, cease the driving and consult with the Engineer and Testing Agency. Drive the replacement pile as directed by the Testing Agency after the extent of obstruction is determined by the Testing Agency.

2. Remove piles which are damaged during handling or driving or which do not meet the specified dimensional, load carrying or material requirements. Provide substitute piles at no cost to the Owner.

E. Pile Cut-Off:

1. Cut-off piles in a horizontal plane within 1 inch below cut-off elevations as indicated and dispose of cut-offs.

1.03 FIELD QUALITY CONTROL:

A. The Contractor shall confirm pile records.

END OF SECTION

SECTION 05116
STRUCTURAL STEEL

PART ONE – GENERAL

1.01 SUMMARY

A. Section Includes: Fabrication and erection of miscellaneous steel required to complete the work indicated on the drawings.

1.02 RELATED WORK

A. Section 09900: Paintings and Coatings

1.03 REFERENCES

A. "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, latest edition.

B. ASTM International, as referenced herein as ASTM.

C. "Code for Welding in Building Construction" of the American Welding Society.

D. The Society for Protective Coatings, as referenced herein as SSPC.

E. The Research Council on Structural Connections, as referenced herein as RCSC.

1.04 SUBMITTALS

A. Shop Drawings

1. Submit complete Shop Drawings complying with the requirements of the current AISC specifications, showing complete information for fabrication and erection of component parts of the structure, including location, size and lengths of bolts and welds.

   a. Prepare erection drawings, complete with all necessary plans, elevation and sections, to indicate size, weight, relative position of members, connection type, size and extent of welds.
   b. Show all welds, both shop and field, by the currently recommended symbols of the American Welding Society.
   c. Indicate for each member, surface preparation as per SSPC and prime painting if specified.
   d. Include erection drawings with each submittal indicating marks of all members, assemblies and loose pieces included in the submittal.
   e. Clearly indicate revisions made on erection drawings and pieces on any re-submittal.

2. The fabricator is responsible for the adequacy of connections designed by the fabricator to performance standard established in the Contract Documents. Approval of Shop Drawing shall not relieve the fabricator of this responsibility.

3. The approval of shop drawings shall be for size and arrangement of principal and auxiliary members and strength of special connections. Any errors in dimensions shown on shop drawings shall be the responsibility of the steel fabricator.

B. Connection Design

1. Base connection design on the load and reaction indicated and follow AISC requirements.

C. Certificates of Compliance

1. Submit Certificates of Compliance for the following:
   a. Tension Control High Strength Bolts.
   b. Paint.
   c. Welding electrodes and rods.
   d. Galvanizing.

D. Mill Test Report

1. Submit certified copies of mill test reports to the inspection and Testing Agency of steel to be used for the Work. Fabricated members which do not meet the requirements of applicable specifications as evidenced by the mill test report will be rejected and shall be replaced.

E. Fastener Certification

1. Submit to the inspection and Testing Agency and the Construction Manager certified copies of mill test reports for the bolts, nuts, and washers from the manufacturer for each shipping lot, complying with the requirements of ASTM A325.

2. Submit to inspection and Testing Agency, a certified statement of compliance that welding materials furnished under this section meets the AWS requirement.

F. Cables and Fittings

1. Submit copies of test results of breaking strength and tests for modulus of elasticity from each manufactured length of strand.

2. Submit the results of proof loading on sockets.

G. Qualification Certificates

1. Submit to the inspection and Testing Agency the names of welders, welding operators and tackers to be employed on the Work together with their welding certificates stating the types of welding and positions for which they are qualified, the codes and procedures under which they are qualified, the dates of qualification and the Testing Agency certifying the qualification tests. Keep the certificates current and filed with the inspection and Testing Agency for the duration of the Contract.

1.05 QUALITY ASSURANCE

A. Qualification

1. Steel Fabricator

a. Fabricator to maintain an agreement with an independent Testing Agency to conduct periodic in-plant inspection at the fabricator's plant, at a frequency that will assure fabricator's quality conformance equivalent to AISC

Fabricator, Standard for Steel Building Structures. Submit certificate from independent Testing Agency if requested.

2. Shop-Painting Applicator
   a. Painting applicator shall be qualified in accordance with SSPC-QP3 Standard Procedure for Evaluating Qualifications of Shop Painting Applicator.

3. Steel Erector
   a. Employ a steel erector who has had a minimum of five years of successful experience in erection of structural steel and is able to furnish evidence of erector's ability, facilities, proficiency of erector's personnel, and completed projects.

4. Welding Work
   a. Employ welding procedures and welding operators who are qualified in accordance with AWS "Qualification" requirements.
   b. Provide certification that welders to be employed have satisfactorily passed AWS qualification test and are currently certified.
   c. If recertification of welders is required, retesting will be Contractor's responsibility.

B. Codes and Standards

1. Comply with provisions of following, except as otherwise indicated: AISC "Code of Standard Practice for Steel Building and Bridges", except where such provisions conflict with the Contract Documents.

C. Correction of Defective Work:

1. Correct Work determined to be defective by the Engineer or the inspection agency or both, regardless of all previous inspection, to the satisfaction of the Engineer.

1.06 PROJECT CONDITIONS

A. Measurements

1. Make such field measurements as are necessary to lay out the Work properly.

1.07 PRODUCT HANDLING

A. Protection

1. Use all means necessary to protect structural steel before, during and after installation and to protect the installed work and material of all other trades.

2. Handle with care to avoid bending, twisting or other damage.

3. Store to allow drainage of water from all parts.

4. Provide blocking to keep all items off ground.

B. Replacements

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

PART TWO – PRODUCTS

2.01 MATERIALS

A. Steel
1. Wide-flange (W) shapes, M-, S-, HP-shapes, channels, angles, plates, and bars shall be ASTM A36.
2. Tube shapes shall be ASTM A500, grade B, Fy=46 ksi.
3. Pipe Sleeve shall be ASTM A252, grade 3, Fy=45 ksi.

B. Forged Steel Structural Hardware
1. Manufactured to provide safe working loads per AISC load tables.

C. Fasteners
1. High strength bolts, nuts, and washers: ASTM A325.
2. All other bolts: ASTM A307
3. All bolts, nuts and washers shall be hot-dip galvanized in accordance with ASTM A153.

D. Filler Material for Welding: American Welding Society Specifications A 5.1 or A 5.5, electrodes for Manual Shielded Metal Arc Welding E 70 Series.

E. Those steel shapes and plates not hot-dip galvanized shall have no shop paint. After fabrication, it shall be cleaned of oil and grease by solvent cleansers and be cleaned of dirt and other foreign materials by thorough sweeping with a fiber brush.

2.02 FABRICATION

A. General

1. Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303-05.

B. Shop Connections

1. Provide all connections necessary for complete erection. Fabricate and assemble in the shop to the greatest extent possible.

C. Fabricate structural steel in accordance with American Institute of Steel Construction

D. Publications

1. Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

E. Code of Standard Practice for Steel Buildings and Bridges.

1. Specification for Structural Joints Using ASTM A325 or A490 Bolts.

F. Weld in accordance with American Welding Society's, "Welding in Building Construction."

1. Where structural connections are made by welding, the details of all joints, the technique of welding employed, the appearance and quality of welds and the methods

used to correct defective work shall conform to the requirements of the reference documents.

G. All shop connections are welded unless detailed otherwise.

H. Members shall be free from bend, warp or other defects.

I. Clean all exposed items of weld splatter and slag.

J. All joints shall be tightly fitted; where exposed welding is required, weld neatly and grind smooth without pits and blemishes.

K. Fit all work together at shop as for as possible and deliver complete and ready for erection. Properly mark and match-mark for field assembly.

L. Provide all bolts, anchors, clips and other anchorages required for structural steel built into or anchored to concrete.

M. Shop Welding

1. Perform welding in accordance with approved welding procedures and AWS D1.1.

2. Enforce and supervise approved procedure for welding during fabrication of structural steel by employing experienced supervisors knowledgeable of good welding practices.

3. Use welding methods and equipment to maintain allowable tolerance. [Appearance and quality of welds to be consistent with approved mock-up].
   a. For grove welds, make weld flush to surfaces each side within +0.0625-inch, -0 inch of plate thickness.
   b. For continuous welds indicated, provide welds of uniform size and profile.
   c. At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material. Surface bleed of far sides welding on exposed surfaces will not be acceptable.

N. High Strength Steel Bolting

1. Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

O. Beams

1. Provide one-piece beams without splice(s), unless otherwise indicated.

P. Tubular, Pipe, and other Closed End Members

1. Provide pipe, and other closed end members with cap plates with watertight welds at the ends and with weep holes where indicated.

Q. Connections for Other Work

1. Notify other trades so that holes in structural steel can be provided for attachments where required. Provide necessary holes if information is received prior to fabrication.

PART THREE – EXECUTION

3.01 EXAMINATION

A. Prior to erection of any steel, start sequential inspection of the pier supports, verify the location and elevation of pile clamps supporting structure. Based on these procedures, the pier supports shall be found acceptable if erection can be accomplished within AISC 303-05 tolerances for plumbness and elevation.

B. Notify Engineer, in writing, the findings of Contractor's inspection listing specifically any discrepancies and reporting as satisfactory all other conditions. Make approved adjustments in structural steel as required to correct errors and discrepancies not reported.

3.02 PREPARATION

A. Surface Preparation for Shop Painting

1. Exterior Preparation

a. Remove all oil and grease contaminants.
b. Clean all exposed steel work, by commercial blast clean conforming to SSPC-SP6 removing completely all dirt, rust mill scale and foreign matter except for slight shadows, streak or discoloration.

3.03 ERECTION

A. General

1. In planning the method of erection, make full allowance for obstructions encountered which may result from work performed by other trades as well as the operations of the Owner.

2. In planning the method of plumbing the structure, make allowance for temperature difference between time of erection and mean operating temperature of structure when completed. Take into account differential temperature effects on column lengths in plumbing when tall frames are subjected to strong sun exposure on one side.

3. Set structural steel accurately and in locations and elevation indicated and as per approved shop drawings and in accordance with AISC 303-05.

4. Comply with federal, state, city and municipal laws for steel erection.

5. The lateral-load resisting system of braced frames, and connecting diaphragm elements provides stability and strength to resist loads for as-designed steel framing. Design and provide temporary supports, such as guys, bracing, falsework, cribbing or other elements required for steel framework erection, including partly assembled steel framing in consideration of noted interaction items. Design temporary supports to withstand all loads to which the structure may be subjected during erection and subsequent construction, including erection equipment.

6. Furnish and place all temporary bracing necessary for erection before bolting or welding. Only light drifting will be permitted to draw parts together. Drifting to match unaligned holes will not be permitted. Perform enlargement of holes necessary to

make connections resulting from misfit by drilling and reaming; then use the proper size bolt.

B. Field Connections

1. Make all field connections as per Contract Documents and approved Shop Drawings.

   a. Install high-strength bolts according to RCSC, “Specification for Structural Joints using ASTM A325 or A490 Bolts".

   b. Orient bolt-heads as indicated on the shop drawings.

2. Unless otherwise indicated, provide a minimum of two bolts for beam connections. Begin connection near top of the web and extend them down to at least 2/3 of beam depth.

3. All bolted connections shall use fastener sets consisting of bolts, nuts, and washers whether directly indicated on the drawings or referenced herein.

C. Field Welding

1. Field welding will be permitted only where indicated on approved Shop Drawings or where otherwise approved by the Engineer. Perform field welding in accordance with the approved welding procedures and AWS D1.1.

D. Erection Tolerance

1. Erect structural steel plumb, level and aligned, with tolerances conforming to AISC "Code of Standard Practice for Steel Buildings and Bridges".

2. The framing shall be carried up true and plumb and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety. It shall be removed by this Contractor as part of his equipment. As erection progressed, the work shall be securely connected to take care of all dead load, wind and erection stresses.

3. Provide steel shims as required to insure that support beams, etc., are level and at the proper elevation.

4. Do all cutting, drilling and fitting necessary to install items.

3.04 CLEANING

A. After erection, clean, degrease and paint in accordance with painting specification.

B. All work shall be free of flaws at completion of project.

END OF SECTION

SECTION 05120
CONTECH BRIDGE

PART 1.0 GENERAL

1.1 Scope

These specifications are for a fully engineered clear span bridge of steel construction and shall be regarded as minimum standards for design and construction. These specifications are based on products designed and manufactured by CONTECH Construction Products, Inc.,

1.2 Qualified Suppliers

Each bidder is required to identify their intended bridge supplier as part of the bid submittal. Qualified suppliers must have at least 10 years experience fabricating these type of structures.

Pre-approved Manufacturers:

CONTECH Construction Products, Inc.

8301 State Highway 29 North
Alexandria, Minnesota 56308
1-800-328-2047

4021 Gault Avenue South
Fort Payne, Alabama 35967
1-800-749-7515

Suppliers other than those listed above may be used provided the engineer or owner's agent evaluates the proposed supplier and approves the supplier 5 business days prior to bid.

The contractor must provide the following documentation, for any proposed supplier who is not pre-approved, at least 10 business days prior to bid:

1. Product Literature

2. All documentation to insure the proposed substitution will be in compliance with these specifications. This shall include:

- Representative design calculations
- Representative drawings
- Splicing and erection procedures
- Warranty information
- Inspection & Maintenance procedures
- Welder Qualifications
- Quality Management System

3. Proposed suppliers must have at least ten (10) years experience designing and fabricating these type structures and a minimum of ten (10) successful bridge projects, of similar construction, each of which has been in service at least seven (7) years. List the location, bridge size, owner, and a contact for reference for each project.

   The engineer will evaluate and verify the accuracy of the submittal prior to bid. If the engineer determines that the qualifying criteria have not been met, the contractor's proposed supplier shall be rejected. The engineer's ruling shall be final.

4. The Manufacturer’s local representative is to be in attendance at the project pre-bid meeting

PART 2.0 GENERAL FEATURES OF DESIGN

2.1 Span

Bridge spans shall be 30’-0”, and shall be as measured from each end of the bridge structure (out to out dimension).

2.2 Width

Bridge width shall be 10’-0” clear and shall be as measured from the inside face of the elements comprising the Safety system or truss structural members (chords or verticals).

2.3 Bridge System Type

Bridge(s) shall be designed as a Half-Through Pony System that has one (1) diagonal per panel and plumb end vertical members. Interior vertical members will be perpendicular to the chord faces.

2.3.1 Bridge(s) shall be designed utilizing an under-hung floor beam (top of floor beam welded to the bottom of the bottom chord) or be designed utilizing an H-Section configuration where the floor beams are placed up inside the trusses and attached to the truss verticals.

2.3.2 The bridge manufacturer shall determine the distance from the top of the deck to the top and bottom truss members based upon structural and/or shipping requirements.

2.3.3 The top of the top chord shall not be less than 42 inches above the deck (measured from the high point of the riding surface) on bike path structures.

2.4 Member Components

All members of the vertical trusses (top and bottom chords, verticals, and diagonals) shall be fabricated from square and/or rectangular structural steel tubing. Other structural members and bracing shall be fabricated from structural steel shapes or square and rectangular structural steel tubing.

Unless the floor and fastenings are specifically designed to provide adequate lateral support to the top flange of open shape stringers (W-shapes or channels), a minimum of one stiffener shall be provided in each stringer at every floor beam location.

2.5 Attachments

2.5.1 Safety Rails – Vertical system

Vertical safety rails or pickets shall be placed on the structure to a minimum height of 3'-0" above the deck surface. The pickets shall be spaced so as to prevent a 4" sphere from passing through the truss. Pickets may be placed on the inside or outside of the structure at the bridge fabricators option. The top of the vertical pickets shall have a continuous cap angle or some other means to prevent bridge users from cutting or scraping their hands.

The picket safety system shall be designed for an infill loading of 200 pounds, applied horizontally at right angles, to a one square foot area at any point in the system.

2.6 Camber

The bridge shall have a vertical camber dimension at mid-span equal to 125% of the full dead load deflection.

2.7 Elevation Difference

The bridge abutments shall be constructed at the same elevation on both ends of the bridge.

PART 3.0 ENGINEERING

Structural design of the bridge structure(s) shall be performed by or under the direct supervision of a Licensed Professional Engineer and done in accordance with recognized engineering practices and principles. The Licensed Professional Engineer is to hold a current P.E. or S.E. license (where required) in the state where the bridge will be erected.

3.1 Design Loads

In considering design and fabrication issues, this structure shall be assumed to be statically loaded. No dynamic analysis shall be required nor shall fabrication issues typically considered for dynamically loaded structures be considered for this bridge.

3.1.1 Dead Load

The bridge structure shall be designed considering its own dead load (superstructure and original decking) only. No additional dead loading need be considered.

3.1.2 Uniform Live Load (Per International Building Code, 2006; Table 1607: Walkways & Elevated Platforms)

3.1.2.1 Pedestrian Live Load

Main Members: Main supporting members, including girders, trusses and arches shall be designed for a pedestrian live load of 60 pounds per square foot of bridge walkway area. The pedestrian live load shall be applied to those areas of the walkway so as to produce maximum stress in the member being designed. If the bridge walkway area to which the pedestrian live load is applied (deck influence area) exceeds 400 square feet, the pedestrian live load may be reduced by the following equation:

$$w = 60\,[0.25 + \frac{15}{\sqrt{A_I}})]$$

Where w is the design pedestrian load (psf) and A_I is the deck influence area in square feet.

The reduced design live load shall not be less than 40 pounds per square foot of bridge walkway area.

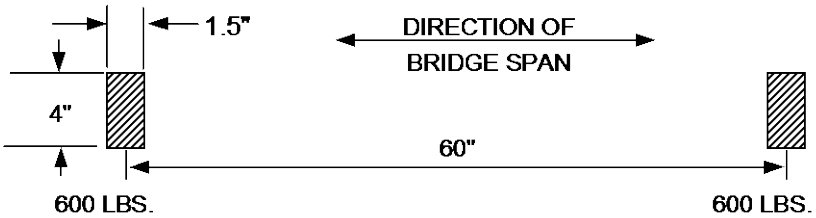
Secondary Members: Bridge decks and supporting floor systems, including secondary stringers, floor beams and their connections to main supporting members shall be designed for a live load of 60 pounds per square foot, with no reduction allowed.

3.1.3 Concentrated Loads

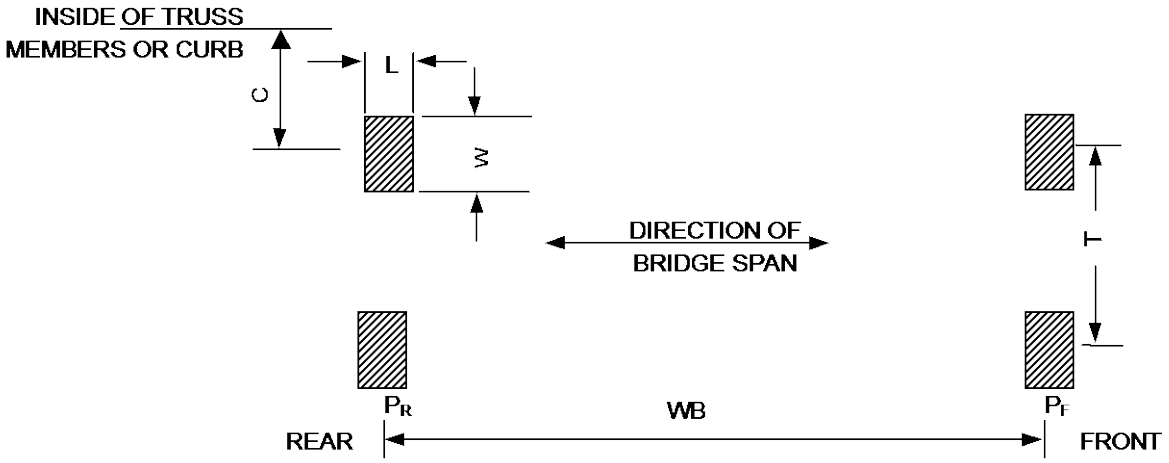
The bridge superstructure, floor system and decking shall be designed for each of the following point load conditions:

3.1.3.1 A concentrated load of 1000 pounds placed on any area 2.5 ft x 2.5 ft square (Verify)

3.1.3.2 A 1200 pound two wheel vehicle with a wheelbase and tire print area as shown in the following diagram:



3.1.3.3 A four wheeled vehicle with the appropriate wheelbase, tire track and tire print area as shown in the following diagram: (See Table I for the values corresponding to the selected vehicle.)



	Vehicle	Axle and Wheel Spacings		Front Wheels			Rear Wheels			
Bridge Width	Weight	WB	T	P_F	L	W	P_R	L	W	C*
6'	4,000#	48"	32"	1,000#	2.0"	5.0"	1,000#	2.0"	5.0"	9"
8'	6,000#	66"	48"	1,500#	2.5"	6.0"	1,500#	2.5"	6.0"	12"
10'	8,000#	102"	60"	1,600#	3.0"	8.0"	2,400#	3.0"	8.0"	15"
12'	10,000#	120"	72"	2,000#	3.5"	8.5"	3,000#	3.5"	8.5"	18"

(*C is the minimum dimension from center of wheel to the inside face of truss or curb.)

TABLE I

All of the concentrated or wheel loads shall be placed so as to produce the maximum stress in each member being analyzed. Critical stresses need be calculated assuming there is only one vehicle on the bridge at any given time. Assumptions that vehicles only travel down the center of the bridge or that the vehicle load is a uniform line load will not be allowed.

Each four wheeled vehicle load listed in Table I, up to and including the maximum weight vehicle selected, must be used in determining critical deck stresses. The wheel distribution for deck design shall be as specified in Section 4.3.1. Stringers shall be designed for the applied wheel loads assuming no lateral load distribution to adjacent stringers.

A vehicle impact allowance is not required.

3.1.4 Wind Load

3.1.4.1 Horizontal Forces

The bridge(s) shall be designed for a wind load of 25 pounds per square foot on the full vertical projected area of the bridge as if enclosed. The wind load shall be applied horizontally at right angles to the longitudinal axis of the structure.

The wind loading shall be considered both in the design of the lateral load bracing system and in the design of the truss vertical members, floor beams and their connections.

3.1.4.2 Overturning Forces

The effect of forces tending to overturn structures shall be calculated assuming that the wind direction is at right angles to the longitudinal axis of the structure. In addition, an upward force shall be applied at the windward quarter point of the transverse superstructure width. This force shall be 20 pounds per square foot of deck.

3.1.5 Top Chord/Railing Loads

The top chord, truss verticals, and floor beams shall be designed for lateral wind loads (per section 3.1.4.1) and for any loads required to provide top chord stability as outlined in Section 3.3.6; however, in no case shall the load be less than 50 pounds per lineal foot or a 200 pound point load, whichever produces greater stresses, applied in any direction at any point along the top chord or at the top of the safety system if higher than the top chord.

3.1.6 Load Combinations

The loads listed herein shall be considered to act in the following combinations, whichever produce the most unfavorable effects on the bridge superstructure or structural member concerned.
[DL=Dead Load; LL = Live Load; WL = Wind Load; VEH = Vehicle Load]
DL + LL
DL + VEH
DL+WL
DL+LL+WL
DL+VEH+.3WL

NOTE: Allowable stresses may be increased 1/3 above the values otherwise provided when produced by wind loading, acting alone or in combination with the design dead and live loads.

It shall be the responsibility of the foundation engineer to determine any additional loads (i.e. earth pressure, stream force on abutments, wind loads other than those applied perpendicular to the long axis of the bridge, etc.) and load combinations required for design of the abutments.

3.2 Design Limitations

3.2.1 Deflection

3.2.1.1 Vertical Deflection

The vertical deflection of the main trusses due to service pedestrian live load shall not exceed 1/400 of the span.

The deflection of the floor system members (floor beams and stringers) due to service pedestrian live load shall not exceed 1/360 of their respective spans.

The service pedestrian live load shall be 60 PSF, reduced in accordance with Section 3.1.2.1, but should in no case be less than 40 PSF for deflection checks.

Deflection limits due to occasional vehicular traffic shall not be considered.

3.2.1.2 Horizontal Deflection

The horizontal deflection of the structure due to lateral wind loads shall not exceed 1/500 of the span under an 85 MPH (25 PSF) wind load.

3.2.2 Minimum Thickness of Metal

All structural steel members shall be in accordance with the AISC Manual of Steel Constructions' "Standard Mill Practice Guidelines". For ASTM A500 and ASTM A847 tubing, the section properties used for design shall be per the Steel Tube Institute of North America's Hollow Structural Sections "Dimensions and Section Properties".

3.3 Governing Design Codes / References

Structural members shall be designed in accordance with recognized engineering practices and principles as follows:

3.3.1 Structural Steel Allowable Stresses

American Institute of Steel Construction (AISC).

Structural steel design shall be in accordance with those sections of the AISC "Manual of Steel Construction: LRFD; (Load Resistance Factor Design) related to design requirements and allowable stresses.

3.3.2 Welded Tubular Connections

American National Standards Institute / American Welding Society (ANSI/AWS) and the Canadian Institute of Steel Construction (CISC).

All welded tubular connections shall be checked, when within applicable limits, for the limiting failure modes outlined in the ANSI/AWS D1.1 Structural Welding Code or in accordance with the "Design Guide for Hollow Structural Section Connections" as published by the Canadian Institute of Steel Construction (CISC).

When outside the “validity range” defined in these design guidelines, the following limit states or failure modes must be checked:

* Chord face plastification
* Punching shear (through main member face)
* Material failure
    - Tension failure of the web member
    - Local buckling of a compression web member
* Weld failure
    - Allowable stress based on “effective lengths”
    - “Ultimate” capacity
* Local buckling of a main member face
* Main member failure:
    - Web or sidewall yielding
    - Web or sidewall crippling
    - Web or sidewall buckling
    - Overall shear failure

All tubular joints shall be plain unstiffened joints (made without the use of reinforcing plates) except as follows:

* Floor beams hung beneath the lower chord of the structure may be constructed with or without stiffener (or gusset) plates, as required by design.

* Floor beams which frame directly into the truss verticals (H-Section bridges) may be designed with or without end stiffening plates as required by design.
* Where chords, end floor beams and in high profiles the top end struts weld to the end verticals, the end verticals (or connections) may require stiffening to transfer the forces from these members into the end vertical.

* Truss vertical to chord connections.

NOTE: The effects of fabrication tolerances shall be accounted for in the design of the structure. Special attention shall be given to the actual fit-up gap at welded truss joints.

3.3.4 Wood

American Institute of Timber Construction (AITC), the U.S. Forest Products Laboratory, and the American Forest & Paper Association (AF&PA).

Sawn lumber shall be designed in accordance with the ANSI/AF&PA NDS, “National Design Standard for Wood Construction”, as published by the American Forest & Paper Association or the “Timber Construction Manual” as published by the American Institute of Timber Construction (AITC).

3.3.5 Concrete

Reinforced concrete shall be designed in accordance with the “Building Code Requirements for Structural Concrete” (ACI 318)

3.3.6 Top Chord Stability

Structural Stability Research Council (SSRC), formerly Column Research Council.

The top chord shall be considered as a column with elastic lateral supports at the panel points. The critical buckling force of the column, so determined, shall exceed the maximum force from dead load and live load (uniform or vehicular) in any panel of the top chord by not less than 50 percent for parallel chord truss bridges. The design approach to prevent top chord buckling shall be as outlined by E.C. Holt's research work in conjunction with the Column Research Council on the stability of the top chord of a half-through truss. See Appendix A for the calculation of the spring constant C and the determination of an appropriate K factor for out-of-plane buckling.

In addition, for the dead load plus vehicle load combination, the spring constant “C” furnished by the transverse “U-Frames” shall not be less than “C” required as defined by:

$$C\ required = \frac{1.46\ P_c}{L}$$

where P_c is the maximum top chord compression due to dead load plus the vehicle load times the appropriate safety factor (1.5 for parallel chord truss bridges) and L is the length in inches of one truss panel or bay.

For uniformly loaded bridges, the vertical truss members, the floor beams and their connections (transverse frames) shall be proportioned to resist a lateral force of not less than 1/100k times the top chord compressive load, but not less than .004 times that top chord load, applied at the top chord panel points of each truss. The top chord load is determined by using the larger top chord axial force in the members on either side of the "U-frame" being analyzed. For end frames, the

same concept applies except the transverse force is 1% of the axial load in the end post member.

For bridges with vehicle loads, the lateral force applied at the top chord elevation for design of the transverse frames shall not be less than 1% of the top chord compression due to dead load plus any vehicle loading
The bending forces in the transverse frames, as determined above, act in conjunction with all forces produced by the actual bridge loads as determined by an appropriate analysis which assumes that the floor beams are “fixed” to the trusses at each end.

NOTE: The effects of three dimensional loading (including “U-frame” requirements) shall be considered in the design of the structure. The “U-frame” forces shall be added to the forces derived from a three dimensional analysis of the bridge.

PART 4.0 MATERIALS

4.1 Steel

4.1.1 Unpainted Weathering Steel

Bridges shall be fabricated from high strength, low alloy, atmospheric corrosion resistant ASTM A847 cold-formed welded square and rectangular tubing and/or ASTM A588, or ASTM A242, ASTM A606 plate and structural steel shapes (Fy = 50,000 psi). The minimum corrosion index of atmospheric corrosion resistant steel, as determined in accordance with ASTM G101, shall be 6.0.

4.3 Decking

4.3.1 Wood Decking

Southern Yellow Pine Lumber #1 common, surfaced four sides (s4s), Trimmed to length, Treated with CCA .60 retention, bending strength of 1600. Product to be graded for low to no wane (above #1 spec).

F_b = 1,300 psi (minimum)

4.3.1.1 Wood Decking Attachment

* At time of installation, planks are to be placed tight together with no gaps.

* Every plank must be attached with at least one fastener at each end.

* All fasteners to be zinc plated. Self-tapping screws or hex-head bolts, with a steel plank holddown, are to be used at the ends of planks. Self-tapping screws or carriage bolts are to be used as interior connection fasteners when required. Power actuated fasteners will not be allowed.

* Planks are to be drilled prior to installation of bolts and/or screws.

* In addition to at least one fastener at each end of every plank (typical for all installations), one (1) additional fastener will be located at the mid-span location of every deck board

NOTE: Attachments at the ends of the planks may be modified as required when obstructions, such as interior safety system elements, prevent installation of the specified hold down system.

PART 5.0 WELDING

5.1 Welding

Welding and weld procedure qualification tests shall conform to the provisions of ANSI/AWS D1.1 “Structural Welding Code”, 1996 Edition. Filler metal shall be in accordance with the applicable AWS Filler Metal Specification (i.e. AWS A 5.28 for the GMAW Process). For exposed, bare, unpainted applications of corrosion resistant steels (i.e. ASTM A588 and A847), the filler metal shall be in accordance with AWS D1.1, Section 3.7.3.

5.2 Welders

Welders shall be properly accredited operators, each of whom shall submit certification of satisfactorily passing AWS standard qualification tests for all positions with unlimited thickness of base metal, have a minimum of 6 months experience in welding tubular structures and have demonstrated the ability to make uniform sound welds of the type required.

PART 6.0 SUBMITTALS

6.1 Submittal Drawings

Schematic drawings and diagrams shall be submitted to the customer for their review after receipt of order. Submittal drawings shall be unique drawings, prepared to illustrate the specific portion of the work to be done. All relative design information such as member sizes, bridge reactions, and general notes shall be clearly specified on the drawings. Drawings shall have cross referenced details and sheet numbers. All drawings shall be signed and sealed by a Professional Engineer who is licensed in accordance with Section 3.0.

6.2 Structural Calculations

Structural calculations for the bridge superstructure shall be submitted by the bridge manufacturer and reviewed by the approving engineer. All calculations shall be signed and sealed by a Professional Engineer who is licensed in accordance with Section 3.0. The calculations shall include all design information necessary to determine the structural adequacy of the bridge. The calculations shall include the following:

* All AISC LRFD stress checks for axial, bending and shear forces in the critical member of each truss member type (i.e. top chord, bottom chord, floor beam, vertical, etc.).
* Checks for the critical connection failure modes for each truss member type (i.e. vertical, diagonal, floor beam, etc.). Special attention shall be given to all welded tube on tube connections (see section 3.3.2 for design check requirements).
* All bolted splice connections.
* Main truss deflection checks.
* U-Frame stiffness checks (used to determine K factors for out-of-plane buckling of the top chord) for all half through or "pony" truss bridges.
* Deck design.

NOTE: The analysis and design of triangulated truss bridges shall account for moments induced in members due to joint fixity where applicable. Moments due to both truss deflection and joint eccentricity must be considered.

6.3 Welder certifications in compliance with AWS standard qualification tests.

6.4 Welding procedures in compliance with Section 5.1.

PART 7.0 FABRICATION

7.1 General Requirements

7.1.1 Drain Holes

When the collection of water inside a structural tube is a possibility, either during construction or during service, the tube shall be provided with a drain hole at its lowest point to let water out.

7.1.2 Welds

Special attention shall be given to developing sufficient weld throats on tubular members. Fillet weld details shall be in accordance with AWS D1.1, Section 3.9 (See AWS Figure 3.2). Unless determined otherwise by testing, the loss factor "Z" for heel welds shall be in accordance with AWS Table 2.8. Fillet welds which run onto the radius of a tube shall be built up to obtain the full throat thickness (See Figure 7.1). The maximum root openings of fillet welds shall not exceed 3/16" in conformance with AWS D1.1, Section 5.22. Weld size or effective throat dimensions shall be increased in accordance with this same section when applicable (i.e. fit-up gaps> 1/16").

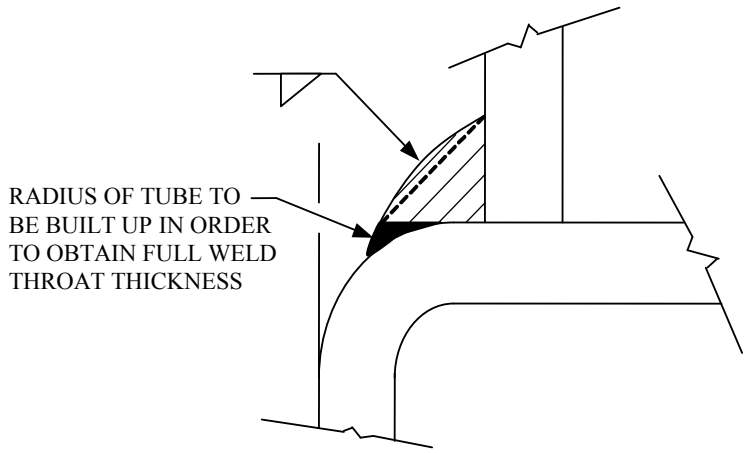


FIGURE 7.1
BUILD UP RADIUS WELD

The fabricator shall have verified that the throat thickness of partial joint penetration groove welds (primarily matched edge welds or the flare-bevel-groove welds on under-hung floor beams) shall be obtainable with their fit-up and weld procedures. Matched edge welds shall be "flushed" out when required to obtain the full throat or branch member wall thickness.

For full penetration butt welds of tubular members, the backing material shall be fabricated prior to installation in the tube so as to be continuous around the full tube perimeter, including corners.

Backing may be of four types:

* A "box" welded up from four (4) plates.
* Two "channel" sections, bent to fit the inside radius of the tube, welded together with full penetration welds.
* A smaller tube section which slides inside the spliced tube.
* A solid plate cut to fit the inside radius of the tube.

Corners of the "box" backing, made from four plates, shall be welded and ground to match the inside corner radii of the chords. The solid plate option shall require a weep hole either in the chord wall above the "high side" of the plate or in the plate itself. In all types of backing, the minimum fit-up tolerances for backing must be maintained at the corners of the tubes as well as across the "flats".

7.2 Quality Certification

Bridge(s) shall be fabricated by a fabricator who is currently certified by the American Institute of Steel Construction to have the personnel, organization, experience, capability, and commitment to produce fabricated structural steel for the category “Major Steel Bridges” as set forth in the AISC Certification Program. Quality control shall be in accordance with procedures outlined for AISC certification. For painted structures, the fabricator must hold a "Sophisticated Paint Endorsement" as set forth in the AISC certification program. Furthermore, the bridge(s) shall be fabricated in a facility owned and/or leased by the corporate owner of the manufacturer, and fully dedicated to bridge manufacturing.

PART 8.0 FINISHING

8.1 Blast Cleaning

8.1.1 Bare applications of enhanced corrosion resistant steels.

All Blast Cleaning shall be done in a dedicated OSHA approved indoor facility owned and operated by the bridge fabricator. Blast operations shall use Best Management Practices and exercise environmentally friendly blast media recovery systems.

To aid in providing a uniformly “weathered” appearance, all exposed surfaces of steel shall be blast cleaned in accordance with Steel Structures Painting Council Surface Preparation Specifications No. 7 Brush-Off Blast Cleaning, SSPC-SP7 latest edition.

Exposed surfaces of steel shall be defined as those surfaces seen from the deck and from outside of the structure. Stringers, floor beams, lower brace diagonals and the inside face of the truss below deck and bottom face of the bottom chord shall not be blasted.

PART 9.0 DELIVERY AND ERECTION

9.1 Delivery is made to a location nearest the site which is easily accessible to normal over-the-road tractor/trailer equipment. All trucks delivering bridge materials will need to be unloaded at the time of arrival.

9.2 The manufacturer will provide detailed, written instruction in the proper lifting procedures and splicing procedures (if required). The method and sequence of erection shall be the responsibility of others.

9.3 The bridge manufacturer shall provide written inspection and maintenance procedures to be followed by the bridge owner.

PART 10.0 BEARINGS

10.1 Bearing Devices

Bridge bearings shall consist of a steel setting or slide plate placed on the abutment or grout pad. The bridge bearing plate which is welded to the bridge structure shall bear on this setting plate. One end of the bridge will be fixed by fully tightening the nuts on the anchor bolts at that end. The opposite end will have finger tight only nuts to allow movement under thermal expansion or contraction.

The bridge bearings shall sit in a recessed pocket on the concrete abutment. Minimum 28-day strength for the abutment concrete shall be 3,000 PSI. The bearing seat shall be a minimum of 16" wide. The step height (from bottom of bearing to top-of-deck) shall be determined by the bridge manufacturer.

PART 11.0 FOUNDATIONS

Unless specified otherwise, the bridge manufacturer shall determine the number, diameter, minimum grade and finish of all anchor bolts. The anchor bolts shall be designed to resist all horizontal and uplift forces to be transferred by the superstructure to the supporting foundations. Engineering design of the bridge supporting foundations (abutment, pier, bracket and/or footings), including design of anchor bolt

embedments, shall be the responsibility of the foundation engineer. The contractor shall provide all materials for (including anchor bolts) and construction of the bridge supporting foundations. The contractor shall install the anchor bolts in accordance with the manufacturer's anchor bolt spacing dimensions.

Information regarding bridge support reactions and anchor bolt locations will be furnished by the bridge manufacturer after receipt of order and after the bridge design is complete.

PART 12.0 PAYMENT

A partial payment or "deposit" for the prefabricated bridge shall be made upon order and storage as required by the terms of the manufacturer.

PART 13.0 WARRANTY

The bridge manufacturer shall warrant their steel structure(s) to be free of design, material and workmanship defects for a period of ten years from the date of delivery. Naturally durable hardwood decking and hardwood attachments shall carry a ten-year warranty against rot, termite damage, or fungal decay. Other types of wood are excepted under this warranty.

This warranty shall not cover defects in the bridge caused by abuse, misuse, overloading, accident, improper maintenance, alteration or any other cause not the result of defective materials or workmanship. This warranty shall be void unless owner’s records can be supplied which shall indicate compliance with the minimum guidelines specified in the inspection and maintenance procedures.

Repair or replacement shall be the exclusive remedy for defects under this warranty. The bridge manufacturer shall not be liable for any consequential or incidental damages for breach of any express or implied warranty on their structure

14.0 APPROVAL CHECKLIST

The following checklist will be used in the evaluation of all submittals to assure compliance with the Special Specifications for Prefabricated Bridge. This checklist is considered the minimum acceptable requirements for compliance with these specifications. Any deviations from this checklist shall be considered grounds for rejection of the submittal. Any costs associated with delays caused by the rejection of the submittal, due to non-compliance with this checklist, shall be fully borne by the contractor and bridge supplier.

SUBMITTAL DRAWINGS
Data Required to be Shown:

- ☐ Bridge Elevation
- ☐ Bridge Cross Section
- ☐ All Member Sizes
- ☐ All Vertical Truss Members are Square or Rectangular Tubing
- ☐ Bridge Reactions
- ☐ General Notes Indicating
- ☐ AISC Stress Conformance
- ☐ Material Specifications to be Followed
- ☐ Design Live Load
- ☐ Design Vehicle Load (If Applicable)
- ☐ Design Wind Load
- ☐ Other Specified Design Loads
- ☐ Welding Process
- ☐ Blast Cleaning
- ☐ Paint System to be Used (If Applicable)
- ☐ Paint Color Chart (If Applicable)
- ☐ Detailed Bolted Splices (If Applicable)
- ☐ Bolted Splice Location (If applicable)
- ☐ Signature and Seal of Professional Engineer, licensed in Accordance with Section 3.0

DESIGN CALCULATIONS
Data Required to be Shown:

- ☐ Data Input for 3-D Analysis of Bridge
- ☐ Joint Coordinates & Member Incidences
- ☐ Joint and Member Loads
- ☐ Member Properties
- ☐ Load Combinations
- ☐ AISC Member Stress Checks for Each Member Type
- ☐ Critical Connection Failure Mode Checks For Each Member Type
  - ☐ Chord Face Plastification Checks
  - ☐ Punching Shear Checks
  - ☐ Material Failure Checks (Truss Webs)
  - ☐ Weld Failure Checks (Effective Length)
  - ☐ Weld Failure Checks (Ultimate)
  - ☐ Local Buckling of the Main Member Face Checks
  - ☐ Main Member Yielding Failure Checks
  - ☐ Main Member Crippling Failure Checks
  - ☐ Main Member Buckling Failure Checks
  - ☐ Main Member Shear Failure Checks
  - ☐ All Bolted Splice Checks (if applicable)
  - ☐ Main Truss Deflection Checks
  - ☐ Decking Material Checks
  - ☐ "U-Frame" Stiffness Checks (if applicable)
  - ☐ Interior and End Portal Design Checks (if applicable)
  - ☐ Determination of Top Chord K Factor Based on "U-Frame" Stiffness (if applicable)
  - ☐ Consideration of Individual Member Moments Due to Truss Deflection, Joint Fixity and Joint Eccentricity

FABRICATION SUBMITTALS
Data Required to be Shown:

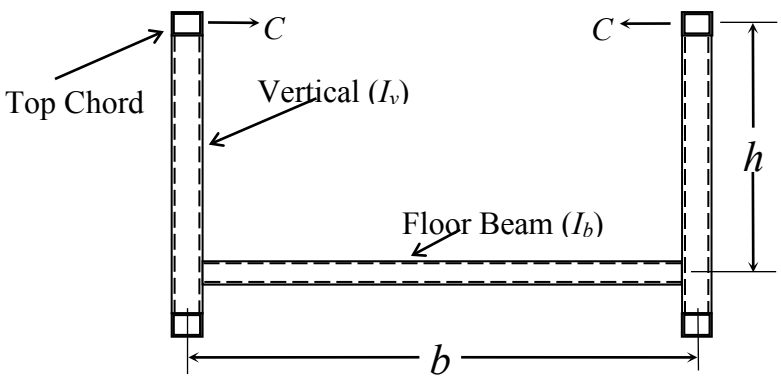
- ☐** Written Installation Instructions
  - ☐** Written Splicing Instructions
- ☐** Written Maintenance & Inspection Instructions
- ☐** Welder Certifications
- ☐** Welding Procedures
- ☐ Material Certifications (if applicable)
  - ☐ Structural Steel (if applicable)
  - ☐ Decking (if applicable)
  - ☐ Structural Bolts (if applicable)
  - ☐** Quality Control Section of AISC Certification Manual (if applicable)
  - ☐** Painter Certifications (if applicable)
  - ☐ Weld Testing Reports (if applicable)

** NOTE: These items are required to be submitted along with Submittal Drawings and Design Calculations. Those Fabrication Submittal Items not marked are be submitted prior to shipment of the bridge.

Appendix A

1/K FOR VARIOUS VALUES OF CL/P_c and n

	n						
1/K	4	6	8	10	12	14	16
1.000	3.686	3.616	3.660	3.714	3.754	3.785	3.809
0.980		3.284	2.944	2.806	2.787	2.771	2.774
0.960		3.000	2.665	2.542	2.456	2.454	2.479
0.950			2.595				
0.940		2.754		2.303	2.252	2.254	2.282
0.920		2.643		2.146	2.094	2.101	2.121
0.900	3.352	2.593	2.263	2.045	1.951	1.968	1.981
0.850		2.460	2.013	1.794	1.709	1.681	1.694
0.800	2.961	2.313	1.889	1.629	1.480	1.456	1.465
0.750		2.147	1.750	1.501	1.344	1.273	1.262
0.700	2.448	1.955	1.595	1.359	1.200	1.111	1.088
0.650		1.739	1.442	1.236	1.087	0.988	0.940
0.600	2.035	1.639	1.338	1.133	0.985	0.878	0.808
0.550		1.517	1.211	1.007	0.860	0.768	0.708
0.500	1.750	1.362	1.047	0.847	0.750	0.668	0.600
0.450		1.158	0.829	0.714	0.624	0.537	0.500
0.400	1.232	0.886	0.627	0.555	0.454	0.428	0.383



" <u>U - Frame</u>"

Where: $C = \dfrac{E}{h^2\,[h/3I_v + b/2I_b]}$

$L = Length\ in\ inches\ of\ one\ truss\ panel$

$P_c = Buckling\ Load\ (= Top\ Chord\ Compression\ x\ F.S.)$

$n = Number\ of\ Panels$

Reference: Galambos, T.V. (1988) "Guide to Stability Design Criteria for Metal Structures", 4th Ed., PP 515-529.
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SECTION 05400
COLD-FORMED METAL FRAMING

PART ONE - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing steel-stud wall.
2. Gypsum sheathing board.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 9 Section "Gypsum Board Assemblies" for gypsum board and nonload-bearing metal-stud framing and ceiling-suspension assemblies.
2. Division 9 Section "Glass Fiber Reinforced Exterior Sheathing" for gypsum sheathing applied to exterior steel framing.

1.3 PERFORMANCE REQUIREMENTS

A. AISI "Specifications": Calculate structural characteristics of cold-formed metal framing according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and the following:

B. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the following minimum physical and structural properties:

1. Physical and Structural Properties: As required for performance.

C. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.

1. Design Loads: As indicated.
2. Design framing systems to withstand design loads without deflections greater than the following:

a. Exterior Nonload-Bearing Curtainwall: Lateral deflection of 1/360 of the wall height.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 deg F (67 deg C).

D. Design exterior nonload-bearing curtainwall framing to accommodate lateral deflection without regard to contribution of sheathing materials.

E. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of cold-formed metal framing, accessory, and product specified.

C. Shop drawings showing layout, spacings, sizes, thicknesses, and types of cold-formed metal framing, fabrication, fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachments to other units of Work.

1. For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for its preparation.

D. Mill certificates signed by manufacturers of cold-formed metal framing certifying that their products comply with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, and galvanized-coating thickness.

1. In lieu of mill certificates, submit test reports from a qualified independent testing agency evidencing compliance with requirements.

E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

F. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Product test reports from a qualified independent testing agency evidencing compliance with requirements of the following based on comprehensive testing:

1. Expansion anchors.
2. Powder-actuated anchors.
3. Mechanical fasteners.

H. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence cold-formed metal framing's compliance with building code in effect for Project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

C. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

D. Fire-Test-Response Characteristics: Where fire-resistance-rated assemblies are indicated, provide cold-formed metal framing identical to that tested as part of an assembly for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: As indicated by design designations listed in UL "Fire Resistance Directory," or by Warnock Hersey or another testing and inspecting agency acceptable to authorities having jurisdiction.

E. Professional Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of cold-formed metal framing similar to this Project in material, design, and extent and that have a record of successful in-service performance.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART TWO - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Dietrich Industries, Inc.
2. Unimast, Inc.
3. Or Architect approved equal.

2.2 MATERIALS

A. Galvanized-Steel Sheet: ASTM A 446 (ASTM A 446M), zinc coated according to ASTM A 525 (ASTM A 525M), and as follows:

1. Coating Designation: G 60 (Z 180).
2. Grade, less than 16. ga.: Grade A, 33,000 psi (230 MPa) minimum yield strength, 20 percent elongation.
3. Grade greater than or equal to 16 ga.: Grade D, 50,000 psi (345 MPa) minimum yield strength, 12 percent elongation.

2.3 WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depths indicated, with lipped flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: As required by structural performance.
2. Flange Width: As required by structural performance.
3. Web: Punched.

B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: As required by structural performance.
2. Flange Width: As required by structural performance.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi (230 MPa).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Gusset plates.
5. Deflection track and vertical slide clips.
6. Stud kickers and girts.
7. Joist hangers and end closures.
8. Reinforcement plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36 (ASTM A 36M), zinc coated by the hot-dip process according to ASTM A 123.

B. Cast-in-Place Anchor Bolts and Studs: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel hex-head bolts and studs; carbon-steel nuts; and flat, unhardened-steel washers. Zinc coated by the hot-dip process according to ASTM A 153.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and a 30-minute working time.

2.8 GYPSUM SHEATHING

A. Glass-Mat Gypsum Board: Gypsum board designed as an exterior substrate for a weather barrier, consisting of a noncombustible water-resistant core, essentially gypsum, surfaced with glass mats on face and back, partially or completely embedded in core, and with unsurfaced square edges. Comply with ASTM C 1177 and requirements indicated below:

1. Type: Type X.

2. Thickness: 5/8 inch (16 mm).

B. Available Products: Subject to compliance with requirements, gypsum sheathing boards that may be incorporated in the Work include, but are not limited to, the following:

C. Products: Subject to compliance with requirements, provide one of the following:

1. Glass-Mat Gypsum Board, Type X:

a. Dens-Glass Gold Firestop; Georgia-Pacific Corp.

G. Sheathing Fasteners: ASTM C 954, steel drill screws, Type S-12 fluted tip, a minimum of 1-1/4 inches (32 mm) long, with organic-polymer coating or other corrosion-protective coating.

2.9 TAPES AND SEALANT

A. Sheathing Tape: Tape specifically designed and manufactured to seal joints in gypsum sheathing against water and air infiltration, formulated with an adhesive that permanently bonds to gypsum sheathing substrates, and as indicated below:

1. Linerless, polypropylene sheathing tape, 0.0027 inch (0.07 mm) thick, 2-1/2 inches (63 mm) wide, composed of oriented polypropylene backing coated with permanent acrylic adhesive formulated to adhere to gypsum sheathing surfaces.
2. Polyethylene tape, 0.025 inch (0.63 mm) thick, 3 inches (76 mm) wide, composed of polyethylene backing coated with synthetic-rubber-based adhesive.
3. Self-adhering, glass-fiber tape, 2 inches (51 mm) wide, 10-by-10 or 10-by-20 threads per inch (25.4 mm), of type recommended by tape manufacturer to use with siliconized emulsion sealant in sealing joints and fasteners for gypsum sheathing, and with a history of successful in-service use.
4. Available Products: Subject to compliance with requirements, sheathing tapes that may be incorporated in the Work include, but are not limited to, the following:
5. Products: Subject to compliance with requirements, provide one of the following:
   a. No. 8086 Contractor Sheathing Tape; 3M Construction Markets.
   b. Perma-Tite Tape--PGM 207A; PermaGlass-Mesh, Inc.
   c. POLYKEN 612 Seam Seal Tape; Polyken Technologies.
   d. Quik-Tape; Quik-Tape, Inc.

B. Silicone Emulsion Sealant: Product complying with ASTM C 834, compatible with sealant tape and gypsum sheathing, recommended by manufacturers of both sheathing and tape for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Product: Subject to compliance with requirements, provide Elmer's Siliconized Acrylic Latex Caulk; Borden, Inc.

2.10 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.

1. Fabricate framing assemblies in jig templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted.
4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to manufacturer's recommendations.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.

C. Fabrication Tolerances: Fabricate assemblies to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART THREE - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements, including installation tolerances and other conditions affecting performance of cold-formed metal framing. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed-on fireproofing is applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed-on fireproofing.

B. After sprayed-on fireproofing has been applied, remove only as much fireproofing as needed to complete installation of cold-formed framing without reducing thickness of fireproofing below that required to obtain fire-resistance rating indicated. Protect remaining fireproofing from damage.

C. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

C. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

D. Provide temporary bracing and leave in place until framing is permanently stabilized.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and double studs, inaccessible upon completion of framing work.

G. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches (406 mm) maximum.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Install horizontal bridging in wall studs, spaced in rows not more than 48 inches (1219 mm) apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, clip angle fastened to webs of punched studs.

2. Bridging: Flat, steel-sheet straps of width and thickness indicated, fastened to stud flanges.

3. Bridging: Combination of flat, steel-sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

E. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtainwall-framing system.

3.5 GYPSUM SHEATHING INSTALLATION

A. General: Install gypsum sheathing board according to manufacturer's instructions and GA-253 "Application of Gypsum Sheathing."

B. Install tongue-and-groove gypsum sheathing horizontally with long edges at right angles to studs with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent board without forcing. Abut ends of boards over centers of studs and stagger end joints. Fasten gypsum sheathing board to framing with self-drilling, bugle-head screws, as follows:

C. Install square end and edged sheathing vertically with long edges parallel to, and centered over, studs. Install solid blocking where end joints do not bear against framing sills or track. Fasten gypsum sheathing board to perimeter framing and to each stud with self-drilling, bugle-head screws, located a minimum of 3/8 inch (9.5 mm) from ends and edges of board units, as follows:

1. Space fasteners to comply with manufacturer's recommendations.
2. Space fasteners not more than 8 inches (203 mm) apart around perimeter at edge and end supports and 8 inches (203 mm) apart at intermediate supports.
3. Space fasteners not more than 4 inches (102 mm) apart around perimeter at edge and end supports and 8 inches (203 mm) apart at intermediate supports.

3.6 TAPE AND SEALANT APPLICATION

A. Sheathing Tape: Apply sheathing tape to joints in sheathing and at joints with dissimilar materials; overlap tape by not less than the tape width at joint intersections. At locations where framing penetrates the sheathing, caulk the hoint between the sheathing and the penetrating item. Joint sealant shall provide for 50% expansion and contraction movement.

1. For polyethylene tape, apply primer, specified by tape manufacturer, to sheathing surfaces. In addition, apply polyethylene tape, 2 inches (50 mm) square, to completely cover each exposed fastener.
2. For glass-fiber tape, apply approximately a 3/8-inch (9.5-mm) bead of siliconized emulsion sealant to tapes along joints and embed sealant into tapes along their entire surface with a trowel. In addition, apply sealant with a trowel to each exposed fastener so that fasteners are completely covered.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: A qualified independent testing agency employed and paid by Owner will perform field quality-control testing.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace Work that does not comply with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.9 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanizing repair paint according to ASTM A 780 and the manufacturer's instructions.

B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing.

   1. Touchup painted surfaces with same type of shop paint used on adjacent surfaces.

C. Protect gypsum sheathing that will be exposed to weather for more than one month as follows:

   1. Protect cutouts, corners, and joints in the sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at the time sheathing is applied.

D. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer to ensure that cold-formed metal framing is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 05425- PRE-ENGINEERED, PRE-FABRICATED LIGHT GAUGE STEEL ROOF TRUSSES

PART ONE - GENERAL

1.1 SUMMARY

A. Section includes pre-engineered, pre-fabricated light gauge cold formed steel framing elements. Work includes:

1. Light Gauge Cold formed steel roof trusses.

2. Anchorage, bracing and bridging.

B. Related work

1. Drywall attachment

2. Roofing, fascia, soffit

1.2 REFERENCES

A. Reference standards:

1. ASTM:

a. ASTM A653/A653M-94 “Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Glavanealed) by the Hot Dip Process.”

b. ASTM A780-93a “Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.”

2. American Welding Society (AWS)

a. AWS D1.1 “Structural Welding Code - Steel.”

b. AWS D1.3 “Structural Welding Code - Sheet Steel.”

1.3 PERFORMANCE REQUIREMENTS

A. AISI “Specifications”: Calculate structural characteristics of cold-formed steel truss members according to AISI’s “Specification for the Design of Cold-Formed Steel Structural Members, 1986 (1990).”

B. Structural Performance: Design, engineer, fabricate, and erect cold-formed steel trusses to withstand specified design loads within limits and under conditions required.

1. Design Loads: As specified.

2. Deflections: Live load deflection meeting the following (unless otherwise specified):

a. Roof Trusses: Vertical deflection less than or equal to 1/240 of the span.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 deg F (67 deg C).

1.4 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each type of cold-formed steel framing and accessory required.

B. Submit shop drawings showing member, type, location, spacing, size and gage of members, method of attachment to supporting members and all necessary erection details. Indicate supplemental bracing, strapping, splices, bridging, accessories and details required for proper installation.

C. Submit detailed roof truss layout.

D. Submit truss drawings, sealed and signed by a qualified registered Professional Engineer, verifying truss' ability to meet local code and design requirements. Include:

1. Description of design criteria.

2. Engineering analysis depicting member stresses and truss deflection.

3. Truss member sizes and gauges and connections at truss joints.

4. Truss support reactions.

5. Top chord, Bottom chord and Web bracing requirements.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Fabrication shall be performed by a cold-formed steel truss fabricator with experience designing and fabricating cold-formed steel truss systems equal in material, design, and extent to the systems required for this Project.

1. Cold Formed steel truss system installation shall be performed by an experienced installer approved by the steel truss system fabricator.

B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."

1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and erection.

B. Store trusses on blocking, pallets, platforms or other supports off the ground and in an upright position sufficiently braced to avoid damage from excessive bending.

C. Protect trusses and accessories from corrosion, deformation, damage and deterioration when stored at job site. Keep trusses free of dirt and other foreign matter.

1.7 PROJECT CONDITIONS

A. During construction, adequately distribute all loads applied to trusses so as not to exceed the carrying capacity of any one joist, truss or other component.

PART TWO - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Alpine TrusSteel, Haines City Florida (800) 755-6001, Tri state CFS, Shephardsville, KY.

2.2 COMPONENTS

A. System components: Alpine TrusSteel light gauge steel roof truss components.

B. Provide manufacturer's standard steel truss members, bracing, bridging, blocking, reinforcements, fasteners and accessories with each type of steel framing required, as recommended by the manufacturer for the applications indicated and as needed to provide a complete light gauge cold formed steel truss system.

2.3 MATERIALS

A. Materials:

1. All component gauges: Fabricate components of structural quality steel sheet per ASTM A653 with a minimum yield strength of 40,000 psi.

2. Bracing, bridging and blocking members: Fabricate components of commercial quality steel sheet per ASTM A653 with a minimum yield strength of 33,000 psi.

B. Finish: Provide components with protective zinc coating complying with ASTM A653, minimum G60 coating.

C. Fastenings:

1. Manufacturer recommended self-drilling, self-tapping screws with corrosion-resistant plated finish. Fasteners shall be of sufficient size and number to ensure the strength of the connection.

2. Welding: Comply with AWS D1.1 when applicable and AWS D1.3 for welding base metals less than 1/8" thick.

3. Other fasteners as accepted by truss engineer.

2.4 FABRICATION

A. Factory fabricate cold-formed steel trusses plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.

1. Fabricate truss assemblies in jig templates.
2. Cut truss members by sawing or shearing or plasma cutting.
3. Fasten cold-formed steel truss members by welding or screw fastening, or other methods as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to cold-formed steel truss component manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

B. Care shall be taken during handling, delivery and erection. Brace, block, or reinforce truss as necessary to minimize member and connection stresses.

C. Fabrication Tolerances: Fabricate trusses to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual trusses no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch.

PART THREE - EXECUTION

3.1 EXAMINATION

A. Examine structure, substrates and installation conditions. Do not proceed with cold-formed steel truss installation until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.2 INSTALLATION, GENERAL

A. General:

1. Erection of trusses, including proper handling, safety precautions, temporary bracing and other safeguards or procedures are the responsibility of the Contractor and Contractor's installer.
2. Exercise care and provide erection bracing required to prevent toppling of trusses during erection.

B. Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at design spacing indicated.

C. Provide proper lifting equipment suited to sizes and types of trusses required, applied at lift points recommended by truss fabricator. Exercise care to avoid damage to truss members during erection and to keep horizontal bending of the trusses to a minimum.

D. Provide framing anchors as indicated or accepted on the engineering design drawing or erection drawings. Anchor trusses securely at bearing points.

E. Install roof framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations.

1. DO NOT cut truss members without prior approval of truss engineer.
2. Fasten cold-formed steel roof framing by welding or screw fastening, as standard with fabricator. Wire tying of roof framing is not permitted.
   a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to cold-formed roof framing Manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
   c. Install roof framing in one-piece lengths, unless splice connections are indicated.
   d. Provide temporary bracing and leave in place until trusses are permanently stabilized.

F. Erection Tolerances: Install trusses to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual trusses no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 ROOF TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to manufacturer's recommendations and requirements of this Section.

B. Space trusses as follows:

1. Truss Spacing: 48 inches.

C. Do not alter, cut, or remove truss members or connections of truss members.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacing indicated.

E. Erect trusses without damaging truss members or connections.

F. Align truss bottom chords with load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.

G. Install continuous bridging and permanent truss bracing per truss design requirements.

H. Install necessary roof cross and diagonal bracing per design professional recommendations.

3.4 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanizing repair paint according to ASTM A 780 and the manufacturer's instructions.

END OF SECTION

SECTION 05520
PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Fabrication and installation of all steel handrails and railings as indicated on plans and as specified herein.

1.02 REFERENCES

A. ASTM International, as referenced herein as ASTM.

B. United States defense standard, as referenced herein as MIL.

C. American Welding Society, as referenced herein as AWS.

1.03 SUBMITTALS

A. Product Data:
1. Submit manufacturer's product specifications and installation instructions for products and processes used in handrails and railings, including finishes and grout.

B. Source Quality Control:
1. Submit shop drawings for fabrication and erection of handrails and railings. Include plans, elevations and details of fittings, connections and anchorages to other work. Provide templates for anchor and bolt installation by others.
2. Where materials or fabrications are indicated to comply with certain requirements for design loadings, include structural details, material properties and other information needed for review.

1.04 QUALITY ASSURANCE

A. Shop Assembly:
1. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel:
1. Steel Pipe: Schedule 40 steel pipe conforming to ASTM A53 type S grade A.
2. Steel Plates, Shapes and Bars: ASTM A48, Class 30.
3. Anchor Bolts: Anchor Bolts shall be hot dipped galvanized threaded rod or bolts with nuts and washers meeting ASTM A325.

B. Non-Shrink Non-Metallic Grout:
1. Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with CE 1107. Provide grout specifically recommended by manufacturer for wet exterior applications of type specified in this section.

C. Welding Electrodes and Filler Metal:
   1. Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, and as required for color match, strength and compatibility in fabricated items.

D. Anchors and Inserts:
   1. Provide anchor as shown of proper type, size and material as shown unless otherwise indicated. Use non-ferrous metal of hot-dipped galvanized anchors for exterior locations and elsewhere as required for corrosion resistance.

E. Primer Paint shall be specially formulated for use on galvanized ferrous metals as recommended by the steel pipe rail manufacturer.

F. Galvanizing Repair Paint:
   1. High zinc dust content paint for re-galvanizing welds in galvanized steel, complying with Military Specification MIL-P-21035 (ships).

2.02 FABRICATION

A. Fabricate handrails and railings to design, dimensions and details shown. Provide handrail and railing members in sizes and profiles indicated, with supporting posts and brackets of size and spacing shown.

B. Welded Connections:

   1, Fabricate handrails and railings of materials for interconnections of members by welding. Preassemble railing units in shop to maximum extent practicable and consistent with shipping and handling limitations. Perform welding to comply with applicable AWS specifications, using method appropriate for metal and finish indicated. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

C. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of handrail and railing components.

D. For exterior handrails and railings, and those exposed to moisture from condensation or other sources, provide weep holes or other means for evacuation of entrapped water in hollow sections of railing members.

E. Brackets, Flanges, Fittings and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings and anchors for interconnection of handrail and railing members to other work, unless otherwise indicated. Furnish inserts and other anchorage devices for connecting handrails and railing to concrete or masonry work. Fabricate and space anchorage devices as indicated and as required to provide adequate support. Coordinate anchorage devices with supporting structure.

2.03 METAL FINISHES

A. All railing and handrails are to be shop primed and painted in accordance with Section 09900.

B. Touch up areas where paint coat has been removed or damaged.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer must examine the areas and conditions under which handrails and railings are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages such as sleeves, concrete inserts, anchor bolts and miscellaneous items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B, Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible.

3.03 INSTALLATION

A. General:
1. Fit exposed connections accurately together to form tight, hairline joints.
2. Perform cutting, drilling and fitting required for installation of handrails and railings. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Do not weld, cut or abrade surfaces of handrails and railing components which have been coated or finished after fabrication, and are intended for field connection by mechanical means without further cutting or fitting.
3. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal-arc welding, for appearance and quality of welds made, and for methods used in correcting welding work. Weld connections which are not to be left as exposed joints, but could not be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat.
4. Adjust handrails and railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated or, if not indicated, as required by design loadings.

3.04 ADJUSTING

A. Protect finishes of railings and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at project completion or when directed by Owner's representative. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units as required.

3.05 CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint; and paint exposed areas with same material.

END OF SECTION

SECTION 05700
DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes fabrication and installation of all site handrails, railings, and gates as indicated on plans and as specified herein.

1.02 RELATED SECTIONS

A. Section 02488: Floating Docks

B. Section 05116: Structural Steel

C. Section 09900: Paintings and Coatings

1.03 REFERENCES

A. ASTM International, as referenced herein as ASTM.

B. American Welding Society, as referenced herein as AWS.

1.04 SYSTEM DESCRIPTION

A. Steel or aluminum post and fencing system

B. Structural Performances: Provide gate and fencing assemblies which, when installed, comply with the following minimum requirements for structural performance, unless otherwise indicated.

1. Toprails shall be capable of withstanding the following loads:

a. Concentrated load of 200 pounds applied at any point in any direction.

b. Uniform load of 50 pounds per linear foot applied in any direction.

2. Intermediate rails, balusters and panel fillers shall be capable of withstanding a uniform load of 25 pounds per square foot of gross area of fencing, including any open areas of which they are a part.

a. Above load need not be assumed to be acting concurrently with uniform horizontal loads on toprails of railing assembly in determining stress on supporting members.

C. Anchorage of railings, fencing and gates shall be capable of withstanding the design loads:

1. Anchoring to concrete shall be concrete epoxy anchors.

2. Anchoring to dock or platform shall be with stainless steel bolts through the structural frame. Design of frame must be coordinated with handrail base plate design.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications and installation instructions for products and processes used in handrails and railings, including finishes and grout.

B. Shop Drawing:

1. Submit shop drawings for fabrication and erection of handrails, railings, and gates. Include plans, elevations and details of fittings, connections and anchorages to other work. Provide templates for anchor and bolt installation.

2. Where materials or fabrications are indicated to comply with certain requirements for design loadings, include structural details, material properties and other information needed for review.

1.06 QUALITY ASSURANCE

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fasteners: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals which are corrosive or incompatible with materials jointed. Al exposed fastener materials shall be stainless steel.

2.02 FABRICATION

A. General: Fabricate handrails, post, cross members, plates, and railings to design, dimensions and details shown. Provide handrail and railing members in sizes and profiles indicated, with supporting posts and brackets of size and spacing shown, but not less than required to support the design loading indicated.

1. Contractor shall field measure railing sections to determine lengths of each section prior to fabrication.

B. Welded Connections: Fabricate handrails and railings of materials indicated below for interconnections of members by welding. Preassemble railing units in shop to maximum extent practicable and consistent with shipping and handling limitations. Perform welding to comply with applicable AWS specifications, using method appropriate for metal and finish indicated. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

C. Provide weep holes or other means for evacuation of entrapped water in hollow sections of railing members.

D. Brackets, Flanges, Fittings and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings and anchors for interconnection of handrail and railing members to other work, unless otherwise indicated. Furnish inserts and other anchorage devices for connecting handrails and railing to concrete or masonry work. Fabricate and space anchorage devices as indicated and as required to provide adequate support. Coordinate anchorage devices with supporting structure.

2.03 METAL FINISHES

A. After welding grind burrs and blemishes smooth.

B. All markings shall be removed from natural finish materials.

C. All fencing and gate sections are to be shop primed and painted in accordance with Section 09900.

D. Touch up areas where paint coat has been removed or damaged.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer must examine the areas and conditions under which handrails, post, plates, and railings are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages such as sleeves, concrete inserts, anchor bolts and miscellaneous items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible.

3.03 INSTALLATION

A. General

1. Fit exposed connections accurately together to form tight, hairline joints.

2. Erect work horizontal to existing dock, rigid, and free from distortion or defects detrimental to appearance or performance.

3. Expansion joints shall be provided as needed to allow for thermal expansion or contraction.

4. Perform cutting, drilling and fitting required for installation of handrails and railings. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Do not weld, cut or abrade surfaces of handrails and railing components which have been coated or finished after fabrication, and are intended for field connection by mechanical means without further cutting or fitting.

B. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal-arc welding, for appearance and quality of welds made, and for methods used in correcting welding work. Weld connections which are not to be left as exposed joints, but could not be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat.

C. Adjust handrails, gates, and railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated or, if not indicated, as required by design loadings.

D. Plates:

1. All edges shall be rounded or beveled

3.04 ADJUST AND CLEAN

A. Protect finishes of railings, posts, cross members, plates, and handrails from damage during construction period by use of temporary protective coverings approved by railing

manufacturer. Remove protective covering at project completion or when directed by Owner's Representative. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units as required.

B. As installation is completed, wash thoroughly using clean water and soap; rinse with clean water. Do not use acid solution, steel wool or other harsh abrasives.

1. If stain remains after washing, remove finish and restore in accordance with NAAMM Metal Finishes Manual.

C. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint.

END OF SECTION

SECTION 06100
ROUGH CARPENTRY

PART ONE - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. Types of work in this section include Rough Carpentry for:

1. Wood grounds, nailers and blocking.

2. Wood furring.

3. Subflooring.

4. Underlayment.

B. Finish carpentry is specified in another section(s) within Division 6.

C. Roofing is specified in Division 7 section.

D. Drywall is specified in a Division 9 section.

1.3 DEFINITIONS

A. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for materials listed below:

1. Underlayment and Subflooring.

B. Materials Certificates: Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use, and submit evidence of compliance with specified requirements. Compliance may be in form of a signed copy of applicable portion of lumber producer's grading rules showing design applicable portion of lumber producer's grading rules showing design values for selected species and grade. Design values shall be as approved by the Board of Review of American Lumber Standards Committee.

C. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storing, installation.

1. Preservative Treatment: For each type specified, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained and conformance with applicable standards.

2. For water-borne treatment include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.

1.5 PRODUCT HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

1. For lumber and plywood pressure treated with water-borne chemicals, sticker between each course to provide air circulation.

1.6 PROJECT CONDITIONS

A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

PART TWO - PRODUCTS

1.8 LUMBER, GENERAL

A. Lumber Standards: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

B. Inspection Agencies: Inspection agencies and the abbreviations used to reference with lumber grades and species include the following:

1. RIS - Redwood Inspection Service

2. SPIB - Southern Pine Inspection Bureau

3. WWPA - Western Wood Products Association

4. APA - American Plywood Association

C. Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.

D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

1. Provide dressed lumber, S4S, unless otherwise indicated.

2. Provide seasoned lumber with 19 percent (19%) maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

1.9 DIMENSION LUMBER

A. For structural framing (2" to 4" thick, 5" and wider) provide following grade and species:

1. Any species of No. 2 grade which meets or exceeds the following values:

a. Fb (minimum extreme fiber stress in bending); 1500 psi

b. E (minimum modulus of elasticity); 1,500,000 psi

1.10 BOARDS

A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:

1. Moisture Content: 19 percent maximum, "S-DRY".

2. Where transparent or natural finish for exterior applications, or no finish is indicated, provide Redwood, Select Heart Grade (RIS).

3. Where painted finish is indicated for interior use, provide No. 1 Boards per SPIB rules, Select Merchantable Boards per WCLIB rules or No. 2 Common Boards and Better per SSPA rules.

B. Concealed Boards: Where boards will be concealed by other work, provide lumber of 19 percent maximum moisture content (S-DRY).

1.11 MISCELLANEOUS LUMBER

A. Provide work for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:

1. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

2. Grade: Standard grade light framing size lumber of any species or board size lumber as required. No. 3 common or standard grade boards per WCLIB or WWPA rules or No. 3 boards per SPIB rules.

1.12 ENGINEERED WOOD PRODUCTS

A. Engineered wood products acceptable to authorities having jurisdiction and with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

B. Laminated-Veneer Lumber: Laminated with an exterior-type adhesive complying with ASTM D 2559, with grain of veneers parallel to their lengths.

1. Extreme Fiber Stress in Bending: 2850 psi (17 MPa).

2. Modulus of Elasticity: 2,000,000 psi (13 800 MPa).

1.13 CONSTRUCTION PANELS

A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood panels and, for products not manufactured under PS 1 provisions, with American Plywood Association (APA) "Performance Standard and Policies for Structural-Use Panels", Form No. E445.

B. Trademark: Factory-mark each construction panel with APA trademark evidencing compliance with grade requirements.

C. Concealed APA Performance-Rated Panels: Where construction panels will be used for the following concealed types of applications, provide APA Performance- Rated Panels complying with requirements indicated for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness.

D. MECHANICAL MEZZANINE FLOOR OSB:

1. Nominal thickness not less than 3/4''.

2. Span Rating: Not less than 48/24.

3. Edge Detail: Tongue and groove.

E. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA0C-D PLUGGED INT with exterior glue, in thickness indicated, or if not otherwise indicated, not less than 5/8".

1.14 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).

B. Building Paper: ASTM D 226, Type I; asphalt saturated felt, non-perforated, 15-lb type.

1.15 WOOD TREATMENT BY PRESSURE PROCESS

A. Preservative Treatment: Where lumber or plywood is indicated as "Trt-Wd" or "Treated", or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB standards listed below. Mark each treated item with the AEPB Quality Mark Requirements.

1. Pressure-treat above-ground items with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, or 19 percent and 15 percent. Treat indicated items and the following:

a. Nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.

b. Wood sills, sleepers, blocking furring, stripping and similar concealed members in contact with masonry or concrete

c. Wood framing members less than 18" above grade.

d. Wood floor plates installed over concrete slabs directly in contact with earth.

2. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment and to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

PART THREE - EXECUTION

1.16 INSTALLATION, GENERAL

A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work to required levels and lines, with members plumb and true and cut and fitted.

C. Securely attach carpentry work to substrate to anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

D. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of work; predrill as required.

1.17 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS

A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Provide permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2" wide and of thickness required to brick face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

1.18 WOOD FURRING

A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.

1. Firestop furred spaces on walls at each floor level and at ceiling line of top story, with wood blocking or incombustible materials, accurately fitted to close furred spaces.

B. Furring to Receive Gypsum Drywall: Unless otherwise indicated, provide 2" x 2" furring at 16" o.c., vertically.

C. Furring to Receive Plaster Lath: Unless otherwise indicated provide 1" x 2" furring at 16" o.c, vertically.

1.19 WOOD FRAMING, GENERAL

A. Provide framing members of sizes and on spaces shown, and frame openings as shown, or if not shown, comply with recommendations of "Manual for House Framing" of National Forest Products Association (N.F.P.A.). Do not splice structural members between supports.

B. Anchor and nail as shown, and to comply with "Recommended Nailing Schedule" of "Manual for House Framing" and "National Design Specifications for Wood Construction" published by N.F.P.A.

C. Firestop concealed spaces of wood framed walls and partitions at each floor level and at the ceiling line of the top story. Where firestops are not automatically provided by the framing system used, use closely-fitted wood blocks of nominal 2" thick lumber of the same width as framing members.

1.20 INSTALLATION OF CONSTRUCTION PANELS

A. General: Comply with applicable recommendations contained in Form No. E 30F, "APA Design/Construction Guide - Residential & Commercial," for types of construction panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Subflooring: Glue-nail to framing.

2. Sheathing: Nail to framing with #8d common nails: 6" on center along supported panel edges and 12" on center at intermediate supports. Spacing of 1/8" is required at all panel ends and edges. Install with the long dimension or strength axis of the panel across supports, and with panel continuous over two or more spans. Suitable edge support shall be provided by use of panel clips (H-clips), tongue-and-groove edges, or lumber blocking between joists. Panel end joints shall occur over framing.

3. Underlayment: Glue-nail to subflooring.

a. Fill and sand edge joints of underlayment receiving resilient flooring.

4. Plywood Backing Panels: Nail to supports.

END OF SECTION

SECTION 06160
SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.

ACTION SUBMITTALS

B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory." GA-600, "Fire Resistance Design Manual."

2.2 WOOD PANEL PRODUCTS

A. Oriented Strand Board: DOC PS 2.

2.3 WALL SHEATHING

A. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

END OF SECTION 061600

SECTION 06200
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior trim.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

a. For exposed lumber, mark grade stamp on end or back of each piece.

B. Softwood Plywood: DOC PS 1.

C. MDF: ANSI A208.2, Grade 130.

2.2 INTERIOR TRIM

A. Moldings and trim for Opaque Finish (Painted Finish): Made to patterns included in WMMPA WM 12.

1. Softwood Moldings: WMMPA WM 4, P grade.

a. Species: Yellow poplar, continuous pieces, or finger jointed.
b. Maximum Moisture Content: 15 percent.

B. Molding Patterns:

1. As indicated in drawings.

2.3 MISCELLANEOUS MATERIALS

A. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

END OF SECTION 06200

SECTION 07193
VAPOR BARRIER

PART ONE - GENERAL

1.1 SCOPE

A. Includes, But is Not Limited To -

1. Furnishing and installing vapor barrier beneath interior subfloor slab.

PART TWO - PRODUCTS

1.2 VAPOR BARRIER

A. 10 mil minimum clear polyethylene sheets meeting requirements of ASTM D 4397-84, "Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications."

PART THREE - EXECUTION

1.3 Lap joints minimum of 6 inches.

END OF SECTION

SECTION 07195
INFILTRATION BARRIER

PART ONE - GENERAL

1.01 SECTION INCLUDES

A. Air leakage criteria for primary air seal building enclosure materials and assemblies.

B. Materials and installation methods supplementing primary air seal materials and assemblies.

C. Air seal materials to connect and seal openings, joints, and junctions between other air seal materials and assemblies.

1.02 REFERENCES

A. ANSI A58.1 – Minimum Design Loads for Buildings and other Structures.

B. ASTM C920 – Elastomeric Joint Sealants.

C. ASTM E283 – Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.

D. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

E. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.03 DEFINITION

A. Air Barrier: A continuous network of materials and joints providing air tightness, with adequate strength and stiffness to not deflect excessively under air pressure differences, to which it will be subjected in service. It can be comprised of a single material or a combination of materials to achieve the performance requirements.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on material characteristics, performance criteria and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation, installation requirements and techniques, product storage and handling criteria.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART TWO - PRODUCTS

2.01 SHEET MATERIALS

A. Dupont “Tyvek” HomeWrap

B. Equal by Raven “Rufco-Wrap”, or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the Work of this section.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07210
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.
2. Vapor retarders.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.

B. Unfaced, Glass-Fiber Sound Attenuation Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
3. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
4. Support faced blankets by taping flanges of insulation to flanges of metal studs.

5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

a. Exterior Walls: Set units with facing placed toward interior of construction.

END OF SECTION 072100

SECTION 07313
ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt shingles.
2. Underlayment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each exposed product and for each color and blend specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research/evaluation reports.

C. Warranties: Sample of special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

1.6 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.

1. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first five years nonprorated.
2. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
   a. CertainTeed Corporation.
   b. GAF Materials Corporation.
   c. Owens Corning.
   d. Approved equivalent.
2. Algae Resistance: Granules treated to resist algae discoloration.
3. Color and Blends: Match existing in shape/style and color.

2.2 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 4869, Type II, asphalt-saturated organic felts, nonperforated.

2.3 VENTS

A. Rigid Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and external deflector baffles; for use under ridge shingles. Minimum 18 square inches of net free area per linear foot.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. GAF Materials Corporation.
      b. Owens Corning.
      c. Approved equivalent.

B. Box Vents: Manufacturer's standard, high-density polypropylene or other UV-stabilized plastic ridge vent with screening and external deflector; for use under ridge shingles. Minimum 55 square inches of net free area.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. GAF Materials Corporation.
      b. Owens Corning.
      c. Approved equivalent.

2.4 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- diameter, deformed shank, sharp-pointed, with a minimum 3/8-inch- diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.

2.5 METAL FLASHING AND TRIM

A. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."

1. Sheet Metal: Aluminum, mill finished.

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with felt underlayment nails.
1. Install fasteners at no more than 36 inch o.c.

3.2 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."

1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

3.3 ASPHALT SHINGLE INSTALLATION

A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.

1. Extend asphalt shingles 3/4 inch over fasciae at eaves and rakes.

2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Fasten asphalt shingle strips with a minimum of four roofing nails located according to manufacturer's written instructions.
1. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.

E. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.

F. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

G. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 07313

SECTION 07461
MINERAL FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SUMMARY

A. This section includes the installation of fiber cement lap siding, Fascia, cornerpost, and trim.

1.2 DESCRIPTION

A. System shall be fiber cement lap siding, Fascia, cornerpost, trim, and all required accessories installed at the location indicated on the drawings.

1.3 SUBMITTALS

A. Provide samples from the manufacturer's full color line for selection by Architect.

B. Submit shop drawings indicating intended compliance with manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. Certifications

1. Upon completion of work, submit manufacturer's certification in writing that the installations meet their requirements.

B. Qualifications

1. Installation shall be performed by individuals experienced in installing the specified materials. Provide written certification to the Architect of the installer's experience prior to commencing with the installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Material shall be stored flat and kept dry prior to installation. Avoid direct contact with the ground.

B. Planks shall be carried on edge.

1.6 WARRANTY

A. Provide manufacturer's standard warranty against product defects.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. James Hardie Siding Products, 1-888-JHARDIE.

2.2 MATERIALS

A. Panels shall consist of Portland Cement, ground sand, and cellulose fiber.

B. Style shall be “Hardiplank Color Plus Collection” select cedar mill (siding panels) and “Hardi trim”, smooth for all Fascia, cornerpost and trim.

C. Dimensions

1. Thickness: siding 7/16", Trim and Fencing ¾"

2. Width: 7¼” (6” exposure)

3. Length: 12’-0”

2.3 FINISHES

A. Planks, Fascia and trim posts shall be factory primed and painted. Mars, or scratches shall be touched up in the field prior to installation and/or after installation.

2.4 QUALITY CONTROL

A. Provide minimum 6” clearance from bottom edge at planks to grade.

B. Provide minimum 2” clearance from bottom of trimmed plank to roof.

C. End joints shall be 1/16” maximum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Contractor to inspect substrate and correct imperfections as instructed by siding manufacturer prior to installation.

3.2 INSTALLATION

A. Nailing

1. Lap planks shall be “blind nailed” at 16” o.c.

2. Nails shall be galvanized siding nail 0.93” shank x 0.222” HD x 2” long minimum.

3.3 FIELD QUALITY CONTROL

A. The completed installation shall be inspected by a manufacturer’s representative for compliance with warranty requirements. Certification of compliance shall be forwarded in writing from manufacturer to the Architect.

3.4 CLEANING

A. Contractor shall clean siding upon the completion of work to the Owner’s satisfaction.

END SECTION

SECTION 07621
ALUMINUM FLASHING AND COUNTER FLASHING

PART 1 GENERAL

1.1 SUMMARY

A. Includes, But is Not Limited To -

1. Furnish and install flashing, counterflashing, and hold-down clips as described in Contract Documents not specified to be of other material.

1.2 SEQUENCING

A. Cooperate with related sections during shop drawing and erection stage.

PART 2 PRODUCTS

2.1 SHEET METAL

A. All aluminum flashing to meet requirements of AISI G90.

1. .040 gauge for hold-down clips and refrigerant line covers.

2. .032 gauge for all other.

3. Exposed side to be finished with Kynar/Hylar base flouropolymer coating 1.0 + or –0.1 mil total dry film thickness. Color to be selected by the Architect.

4. A wash coat of .3 - .4 dry film thickness shall be applied on the reverse side.

2.2 SCREWS, BOLTS, NAILS, AND ACCESSORY FASTENERS

A. Of strength and type consistent with function.

2.3 Fabrication

A. Form accurately to details.

B. Profiles, bends, and intersections shall be even and true to line.

C. Fold exposed edges 1/2 inch to provide stiffness.

2.4 MANUFACTURERS

A. Colorklad, 1-800-328-7800.

B. Cheney Flashing Company, 1-800-322-2873.

C. Fry Reglet, 1-404-441-2337

D. Architect approved equivalent.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install with small, watertight seams.

B. Slope to provide positive drainage.

C. Provide sufficient hold down clips to insure true alignment and security against wind.

D. Provide 4 inch minimum overlap.

E. Allow sufficient tolerance for expansion and contraction.

F. Insulate work to prevent electrolytic action.

G. Adhere to Manufacturer's installation procedures.

3.2 ADJUSTING, CLEANING

A. Leave metals clean and free of defects, stains and damaged finish.

END OF SECTION

SECTION 07637
ALUMINUM DOWNSPOUTS AND GUTTERS

PART 1 GENERAL

1.1 SCOPE

A. Includes, But is Not Limited To -

1. Gutters at eaves around perimeter of building.

1.2 SYSTEM DESCRIPTION

A. Hanger system shall be appropriate type as detailed in SMACNA manual, 3rd Edition.

B. Cross-sectional configuration of gutter shall be Style A, Plate 2 of SMACNA Manual 3rd Edition.

PART 2 PRODUCTS

2.1 MATERIAL

A. Downspouts

1. 3" x 4", rectangular and corrugated, 0.027 inch aluminum including necessary elbows.

B. Gutters

1. 0.027 inch minimum aluminum, 6 inch deep continuous.

C. Downspouts, Gutters, Hangers, Fasteners, & Accessories

1. Shall be of compatible material.

2.2 FINISH

A. Fluoropolymer Resin-base finish for coil coating components. Thermo cured two coat system consisting of primer and top coat factory applied over properly pretreated metal.

B. Equal to Duranar 200 by PPG or Fluropon by DeSoto containing 70% minimum Kynar 500 by Pennwalt Corp.

C. Gutter and downspouts will be required to be re-painted in the field.

2.3 SCREWS, BOLTS, NAILS & ACCESSORY FASTENERS

A. Of strength and type consistent with function.

2.4 FABRICATION

A. Fabricate in accordance with SMACNA manual 3rd Edition.

B. Form accurately to details.

C. Profiles, bends, and intersections shall be even and true to line.

PART 3 EXECUTION

3.1 PREPARATION

A. Before starting work, verify governing dimensions at building. Inspect for conditions which would prevent installation of a first class system. Do not install over improper conditions.

3.2 INSTALLATION

A. Install in accordance with SMACNA Manual 3rd Edition.

B. Insulate work to prevent electrolytic action.

C. Furnish and install outlet tubes and gutter ends where required. Furnish and install expansion joints in runs exceeding 50 feet and in runs which are restrained at both ends.

D. Lap joints in gutter one inch, apply sealant specified in Section 07 920 in joint, and rivet 2 inches on center.

E. Lap joints in downspouts at least 1-1/2 inches in direction of water flow.

F. At completion of this work, block downspouts and flood gutters in presence of Architect. Repair leaks and adjust gradients for proper drainage.

3.3 ADJUSTING, CLEANING

A. Leave metals clean and free of defects, stains, and damaged finish.

END OF SECTION

SECTION 07900
JOINT SEALERS

PART 1 - GENERAL

1.1 SCOPE

A. Includes, But is Not Limited To -

1. Furnishing of all labor, tools, equipment and services necessary for and reasonably incidental to the execution of caulking and sealant work shown on the drawings as specified.

B. Work to be caulked: Areas listed below.

1. Exterior -
   a. Perimeter of exterior openings where frames meet exterior facade of building (i.e., precast, brick, or stone) - one or two part polyurethane sealant.
   b. Control and expansion joints in exterior surfaces of unit masonry walls - one or two part polyurethane.
   c. Cornice and wash (or horizontal surface joints) one or two part polyurethane.
   d. Exterior joints in a horizontal wearing surface (as itemized) one or two part polyurethane self-leveling grade.
   e. Expansion joints in concrete deck.

2. Interior -
   a. Seal interior perimeter of exterior openings as detailed on drawings - one or two part polyurethane.
   b. Control and expansion joints on the interior of exterior surfaces of unit masonry walls - one or two part polyurethane.
   c. Interior control and expansion joints in floor surfaces - one or two part polyurethane self-leveling grade.
   d. Perimeter of interior frames, as detailed and itemized - one or two part polyurethane.
   e. Interior masonry vertical control joints (block-to-block concrete, and intersecting masonry walls) - one or two part polyurethane.
   f. Perimeter of bath fixtures (e.g., sinks, tubs, urinals, stools, water closets, basins, vanities) silicone sealant, fungus and mildew resistant.
   g. Exposed interior control joints in drywall-acrylic-latex.

1.2 QUALITY ASSURANCE

A. Use only qualified workmen thoroughly skilled and trained in the techniques of caulking, who can demonstrate to the satisfaction of the Architect, their ability to perform the work in a satisfactory manner.

B. Mixing and application of the sealant shall be in strict accordance with the manufacturer's printed direction.

1.3 SUBMITTALS

A. Submit samples of caulking and sealing compound for approval.

1.4 DELIVERY, STORAGE & HANDLING

A. Deliver caulking and sealing compounds to the job in unbroken, sealed containers bearing the manufacturer's mixing directions. Store materials in sealed containers in a dry protected area above the ground or floor.

B. Protect caulking materials before, during and after installation. Protect the work of other trades during installation.

C. Do not use caulking materials that have been stored for a period of time exceeding the maximum recommended shelf life of the materials.

1.5 GUARANTEE

A. "Contractor warrants workmanship for a period of two (2) years in accordance with terms of the contractor's written warranty. Materials are warranted in accordance with the manufacturer's written warranty.

1.6 JOB CONDITIONS

A. The joint configuration, the joint surfaces and backing forming the sealant rabbet shall be as detailed in the drawings and in accordance with the contract specifications. All known detrimental conditions shall be reported immediately in writing to the General Contractor and/or Architect for correction by the General Contractor.

B. Do not proceed with the installation of sealant if the joint width is less than design, until written notification of the conditions is submitted to the General Contractor and a written acknowledgement with order to proceed is provided by the General Contractor.

C. Do not proceed with the installation of sealant under adverse weather conditions when joints to be sealed are damp, wet, or frozen, or when temperatures are below or above the manufacturer's recommended limitations for installation. Consult the manufacturer for specific instructions before proceeding.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Sonneborn, Dow Corning, General Electric (silicone)

B. Sonneborn, Sika, Tremco (polyurethane)

C. Sonneborn, Tremco (acrylic latex)

2.2 Silicone Sealant - Omniseal or Omniplus

A. One part, non-sag FSTT-S-0901543A

B. Hardness: 15-25 Shore A

C. Movement: plus or minus 25% movement minimum

D. Tensile strength: 150 psi at maximum elongation

2.3 POLYURETHANES

1. Two (2) Part
   a. Self-leveling: TT-S-00227E Class A, Type I, ASTM-C 920 Type M, Grade P, Class 25, Sonolastic Paving Joint Sealant.
   b. Gun Grade TT-S-00227E, Class A, Type II, ASTM-C 920 Type M Grade NS, Class 25, Sonolastic NPII.

2. One (1) Part
   a. Self-leveling TT-S-00230C Class A, Type I, ASTM-C 920 Type S, Grade P, Class 25, Sonolastic SLI.
   b. Gun Grade TT-S-00230C Class A, Type II, ASTM-C 920, Type S, Grade NS, Class 25, Sonolastic NPI 3. Modified Polyurethane ASTM-C 920, Type S, Grade P, Class 2, Sonomeric CT J.

2.4 ACRYLIC LATEX ASTM-C 834 76 SONOLAC

2.5 PREFORMED COMPRESSIBLE & NON COMPRESSIBLE FILLERS

A. Preformed Compression seals (neoprene)

B. Preformed impregnated closed or open cell foamed sealant.

C. Preformed non-impregnated open or closed cell sealant.

2.6 PERFORMANCE REQUIREMENTS

A. Specifications: Conform to applicable Federal or ASTM Specification.

B. Color: As selected by Architect from manufacturer's standard color-or special color if applicable.

C. Sealant Primer: Suitable to the substrate surface as recommended by the sealant manufacturer. Knowledge of whether the primer is staining or non-staining should be obtained prior to application.

D. Joint Backing: Preformed compressible, resilient, non-waxing, non-extruding, non-staining strips or rod (polyethylene, urethane, foam) as recommended by sealant manufacturer backing shall be of size and shape to suit the various conditions and shall be compatible with the sealant, primers and substrates.

E. Bond Breaker: As recommended by the sealant manufacturer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Joint surfaces to receive a sealant shall be sound, clean, dry and free of all visible contaminants.
B. Joint Size is to be determined by the Architect and/or Engineer based upon building movement, sealant capabilities, and substrate requirements.

3.2 PREPARATION OF SURFACES

A. Primer - Thoroughly clean joints and apply primer, if recommended by manufacturer to a dry surface. Apply primer prior to installation of joint backer, bond breaker, or sealant.

B. Joint Backing - In joints where the depth of the joint exceeds the required depth of the sealant, install joint backing to provide backing and uniform depth of sealant. Joint backing shall be installed with approximately 30% compression. Do not stretch, twist, puncture, or tear joint backing. Butt joint backing at intersections.

C. Bond Breaker Tape - Install bond breaker tape smoothly at back of joint where joint backing is not required or cannot be installed (sealant shall adhere only to the sides and not to the back of the joint so as to eliminate "three point adhesion").

3.3 INSTALLATION

A. Sealant Application - Apply sealant in accordance with manufacturer's application manual or instructions, using hand guns or pressure equipment, with proper nozzle size, on clean, dry, properly prepared substrate. Force sealant into joint and against the side of joint to make uniform. Avoid pulling the sealant from sides. Fill sealant space completely with sealant.

B. Tooling - Tooling is required to insure firm full contact with the interfaces of the joint. Tool joint to form smooth, uniform beads with slightly concave surfaces. Finish joints shall be straight, uniform, smooth and neatly finished. Remove any excess sealant from adjacent surface of joint, leaving work in a neat, clean condition.

C. Where an irregular surface or sensitive joint border exists, the applicator shall apply masking tape at edges of joint to insure joint neatness and protection. Tape to be removed after sealant is applied.

3.4 CLEANING

A. Cleaning off excess compound or smears with cleaning material recommended by manufacturer of compound. Leave work in a condition satisfactory to Architect.

END OF SECTION

SECTION 08111
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Verification:

1. If requested by the Architect, provide the following items, prepared on Samples about 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:

   a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
   b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

D. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Amweld Building Products, LLC.
4. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.

2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
   b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.

      1) Locations: Exterior doors.

3. Vertical Edges for Single-Acting Doors: Beveled edge.

   a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames as full profile welded unless otherwise indicated.
   3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.

   1. Fabricate frames with mitered or coped corners.

2. Fabricate frames as knocked down unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
5. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
6. Frames for Borrowed Lights: Same as adjacent door frame.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

1. Provide terminated stops only where indicated.

2.8 LOUVERS

A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- ((0.5-mm-)) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.

2.9 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.10 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Two anchors per jamb up to 60 inches (1524 mm) high.
2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Three anchors per jamb up to 60 inches (1524 mm) high.
2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.
d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.

5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08111

SECTION 08210
WOOD DOORS - SOLID CORE

PART 1 GENERAL

1.1 SCOPE

A. Includes, But is Not Limited To -

1. Furnishing wood doors with openings as necessary.

1.2 QUALITY ASSURANCE

A. Conform to Industry Standard ANSI/NWMA IS 1-80 additional requirements given below.

B. All doors shall have the manufacturer's name permanently affixed between the top of the door and the top hinge location.

C. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies in accordance UL10c, Positive Pressure Fire Door test Method and which are labeled and listed for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Doors: comply with UL10c where required.

2. Provide smoke gaskets or fire seals as required by manufacturers' individual authorities in compliance with UL-10c.

1.3 SHOP DRAWINGS

A. Four copies required.

1.4 PRODUCT DELIVERY, STORAGE & HANDLING

A. Store flat on a level surface in a dry, well ventilated building. Cover to keep clean but allow air circulation.

B. Handle with clean gloves and do not drag doors one another or across other surfaces.

C. Do not subject doors to abnormal heat, dryness, or humidity.

D. Deliver in clean truck and, in wet weather, under cover.

E. Deliver to building site after plaster, cement, and taping compound are dry.

1.5 WARRANTY

A. Similar to that provided by the National Woodwork Manufacturer's Association, Chicago, IL. (latest edition & revision) with following revisions:

1. Interior doors shall be warranted for one year.

2. Warranty shall include finishing, hanging, and installing hardware if defect was discovered after door was finished and installed.

PART 2 PRODUCTS

2.1 TYPE

A. Regular Doors - AWI Spec Symbol PC-5, Flush

B. Fire Rated Doors - AWI Spec Symbol FD 1/3, FD 1/2, FD 3/4, FD 1 or FD 1-1/2 as required by Contract Documents.

2.2 CORE MATERIAL

A. Regular and 1/3 FD Doors; For door elevation types - Flush, Narrow Lite, Half Glass:

1. 1-3/4 inch doors shall have 28 to 32 lb Density cores meeting requirements of ANSI A208.1 Mat Formed Wood Particle Board, Grade 1-l-1.

B. Regular and 1/3 FD Doors; For door elevation types - Full Glass:

1. 1-3/4 inch doors shall have an engineered wood product core. Cores to meet ANSI WDMA I.S. 1-A Performance Duty Level: Extra-Heavy Duty. Acceptable engineered wood product cores are:

a. Structural Composite Lumber (SCL)

b. Parallel Strand Lumber (PSL).

C. Fire-Rated 1/2 FD or more Doors -

1. Mineral as standard with approved Manufacturer. All doors to have 6” top rail blocking.

2. UL 10c Category A.

2.3 VENEER

A. Plain sliced Birch meeting requirements of ANSI/HPMA HP 1983 "A" Face or AWI Grade 1, 1/50 inch thick minimum solid wood.

B. So called "two-ply" veneers are not acceptable.

C. Edge strips 1 3/8 inch top and bottom and 1 1/8 inch on sides to be same veneer as face.

2.4 FINISH

A. Doors shall be pre-finished by the manufacturer. Color selection by Architect. Doors are to be sealed at both top and bottom.

2.5 APPROVED MANUFACTURERS

A. Algoma Hardwoods Inc., Algoma, WI

B. Eggers Hardwood Products Corp, Neenah, WI

C. Graham, Mason City, IA

D. Marshfield Door Systems, Marshfield, WI

PART 3 EXECUTION

3.1 WOOD DOORS

A. Install with 3/16 inch clearance between door and frame. Form a square frame with jambs and stops.

B. Install door according to Manufacturer recommendations. When finished, doors shall not bind, stick, or be mounted so as to cause future hardware difficulties.

C. Do not impair utility or structural strength of door in fitting of door, applying hardware, or cutting and altering door louvers, panels, or other special details.

D. Read Hardware Manufacturer's instructions prior to mounting hardware and follow as closely as possible.

E. Use hardware templates furnished by manufacturer when mounting hardware.

F. Set hinges flush with edge surface. Be sure that hinges are set in a straight line to prevent distortion.

G. Mount door latches high in strike plate opening so when door later settles, latch will not bind.

H. Mount closers on stop side of door (Parallel Arm) where possible.

I. Provide wood ‘L’ bead type trim to completely cover exposed edge of light openings. Trim to be compatible with face veneer.

J. Install hardware in accordance with ANSI/WDMA 1.5 IAH

3.2 CLEANING AND TOUCHUP

A. Inspect all wood doors prior to hanging them on the job. Repair noticeable marks or defects that may have occurred from improper storage and handling.

B. Field repairs and touchups are the responsibility of the installing contractor upon completion of initial installation. Field touchup shall include the filling of exposed nail or screw holes, re-finishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and mars and final cleaning of finished surfaces.

C. When cleaning door surfaces, use a non-abrasive commercial cleaner designed for cleaning wood door or paneling surfaces, that does not leave a film residue that would build up or affect the surface gloss of the door finish.

3.3 ADJUSTMENT AND MAINTENANCE

A. Insure that all doors swing freely and do not bind in their frame. Adjust the finish hardware for proper alignment, smooth operation and proper latching without unnecessary force or excessive clearance.

B. Review with the Owner/Owner's representative how to periodically inspect all doors for wear, damage and natural deterioration.

C. Review with the Owner/Owner's representative how to periodically inspect and adjust all hardware to insure that it continues to function as it was originally intended.

D. Finishes on exterior doors may deteriorate due to exposure to the environment. In order to protect the door it is recommended that the condition of the exterior finish be inspected at least once a year and refinished as needed. Both exterior and interior finishes will change color over time.

END OF SECTION

SECTION 08400
ALUMIUM STOREFRONT, ENTRANCES AND WINDOWS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior entrance systems.

2. Exterior storefront systems.

3. Exterior windows.

1.2 SYSTEM DESCRIPTION

A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:

1. Air infiltration and water penetration exceeding specified limits.

2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Thermally Broken Construction: Provide systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

D. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.

1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch (19 mm), whichever is smaller, unless otherwise indicated.

2. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.

a. Test Pressure: 150 percent of inward and outward wind-load design pressures.

b. Duration: As required by design wind velocity; fastest 1 mile (1.609 km) of wind for relevant exposure category.

E. Dead Loads: Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.

1. Provide a minimum 1/8-inch (3.18-mm) clearance between members and top of glazing or other fixed part immediately below.

2. Provide a minimum 1/16-inch (1.59-mm) clearance between members and operable windows and doors.

F. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

G. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. (0.3 L/s/sq. m) of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75.2 Pa).

H. Water Penetration: Provide storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. (299 Pa). Water leakage is defined as follows:

1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that are drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

I. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

J. Structural-Support Movement: Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.

K. Condensation Resistance: Provide storefront systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.

L. Average Thermal Conductance: Provide storefront systems with average U-values of not more than 0.63 Btu/sq. ft. x h x deg F (3.57 W/sq. m x K) when tested according to AAMA 1503.1.

M. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.3 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

1. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

E. Sealant Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturers' written interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

F. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of entrance and storefront systems with requirements based on comprehensive testing of current systems.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

B. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.

1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.6 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.

2. Adhesive sealant failures.

3. Cohesive sealant failures.

4. Failure of system to meet performance requirements.

5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

6. Failure of operating components to function normally.

7. Water leakage through fixed glazing and frame areas.

C. Warranty Period: 2 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: System shall be “Kawneer”. “Kawneer” FA-Set 400T inside glazed. Equivalent system by the following manufacturer may be considered.

1. EFCO Corporation

2. Equal as approved by Architect

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).

2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).

3. Extruded Structural Pipe and Tubes: ASTM B 429.

4. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).

B. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.

C. Glass

1. Glass is to be 1” insulated glass units utilizing warm edge technology.

a. Air spacer to be continuous, one piece, tin plated steel U channel.

b. Desiccated butyl is to be extruded onto inside web of U channel, full perimeter.

c. Glass shall be tinted. Submit tint samples to Architect for selection.

D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

E. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

F. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."

G. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.3 COMPONENTS

A. Doors: Provide manufacturer's standard 1-3/4-inch- (44.5-mm-) thick glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.

1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.

2. Stile Design: Medium stile; 3-1/2” inches (88.9 mm) nominal width

B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.

2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.

F. Concealed Flashing: Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, complying with ASTM A 666, of type selected by manufacturer for compatibility with system.

G. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:

1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.

2. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

H. Panning and trim per details. Similar panning and details may be acceptable on approval from architect. Panning shall be fully gasketed and frames shall be held to panning by stainless steel retaining clip. Wrap around panning will not be acceptable.

I. Applied muntin grid per details. Surface applied muntins to be glazed into window glazing pocket, mechanically fastened or adhered to glass muntins will not be acceptable. Muntins shall be beveled perimeter muntin shall have bevel as well.

2.4 HARDWARE

A. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated.

B. Thresholds: At exterior doors, provide manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 1/2-inch-high, with beveled edges providing a floor level change with a slope of not more than 1:2.

2.5 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

G. Glazing Channels: Provide minimum clearances for thickness and type of plastic sheet indicated according to plastic sheet manufacturer's written instructions.

H. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

J. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

K. Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions. Kynar 50% complying with AAMA 605.2. Color to be medium bronze. Submit samples to Architect for approval.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."

E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.

H. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet, 1/4 inch over total length.

2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08700
FINISH HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

a. Swinging doors.

2. Cylinders for doors specified in other Sections.

B. Related Sections include the following:

1. Division 08 Section "Hollow Metal Doors and Frames".
2. Division 08 Section "Wood Doors".
3. Division 08 Section “Aluminum Storefront Entrances”

1.3 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

C. Qualification Data: For Architectural Hardware Consultant.

D. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

E. Warranty: Special warranty specified in this Section.

F. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
b. Content: Include the following information:

1) Identification number, location, hand, fire rating, and material of each door and frame.
2) Type, style, function, size, quantity, and finish of each door hardware item.
3) Complete designations of every item required for each door or opening including name and manufacturer.
4) Fastenings and other pertinent information.
5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) Door and frame sizes and materials.
9) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
10) List of related door devices specified in other Sections for each door and frame.

c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

A. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

C. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.6 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, access control system.

C. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of operators and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, except as follows:

a. Exit Devices: Five years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.
c. Locksets: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
2. All products must be “BHMA Certified”.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Approved Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2. Manufacturers listed in **BOLD FONT** below are those used in the hardware sets.

2.2 HINGES

A. Approved Manufacturers:

1. McKinney Products Company; an ASSA ABLOY Group company (MC).
2. Hager Companies.
3. Stanley Commercial Hardware; Div. of The Stanley Works.

2.3 MECHANICAL LOCKS AND LATCHES

A. Approved Manufacturers: (Grade 1 Hardware)

1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CO).
2. SARGENT Manufacturing Company; an ASSA ABLOY Group Company.
3. Yale Architectural Hardware; an ASSA ABLOY Group Company.

2.4 KEYING

A. Keying System: Factory registered.

1. Key to Owners requirements.

B. Keys: Nickel silver.

1. Quantity: In addition to two extra keys blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.
c. Grand Master Keys: Five.

2.5 CLOSERS (Grade 1)

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with ANSI A117.1.

1. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Approved Manufacturers:

a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CO).
b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
c. Norton Door Controls; an ASSA ABLOY Group company.

2.6 PROTECTIVE TRIM UNITS

A. Approved Manufacturers: Provide as specified.

1. McKinney Products Company; an ASSA ABLOY Group Company (MC)
2. Rockwood Manufacturing Company.
3. Hager Companies.
4. IVES Hardware; an Ingersoll-Rand Company.

2.7 DOOR GASKETING

A. Approved Manufacturers: Provide as specified.

1. **McKinney Products Company; an ASSA ABLOY Group Company (MC).**
2. Hager Companies.
3. National Guard Products.
4. Pemko Manufacturing Co.

2.8 THRESHOLDS

A. Approved Manufacturers:

1. **McKinney Products Company; an ASSA ABLOY Group Company (MC).**
2. Hager Companies.
3. National Guard Products.
4. Pemko Manufacturing Co.

2.9 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:

a. Mortise hinges to doors.
b. Strike plates to frames.
c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

   a. Surface hinges to doors.
   b. Closers to doors and frames.
   c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.10 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SETS

SET 01

Doors: 102B

3 Hinges
1 Lockset (Office)
1 Protection Plate (Kick)
1 Wall Stop
3 Silencers

SET 02

Doors: 110B, 111B

3 Hinges
1 Latchset (Privacy)
1 Wall Stop
3 Silencers

SET 03

Doors: 109A

3 Hinges
1 Lockset (Storeroom)
1 Wall Stop
3 Silencers
1 Threshold (exterior doors only)

SET 04

Doors: 102A, 103A, 104A, 105A, 106A, 107A, 108A, 110A & 111A

3 Hinges
1 Lockset (Passage)
1 Dead Lock
2 Silencers
1 Threshold
1 Set Weather Stripping

SET 05 (Storefront)

Doors: 101A

Manufacturers full set hardware including but not limited to flush bolts, deadbolts, and closers and as follows:

Pivot hinges
Push pulls
Stops
Saddle type threshold
Weather Stripping

END OF SECTION 08710

SECTION 09260
GYPSUM WALLBOARD

PART 1 GENERAL

1.1 SCOPE

A. Includes, But is Not Limited To -

1. Interior walls and ceilings where shown on drawings.

1.2 JOB CONDITIONS

A. Environmental Requirements

1. Temperature shall be 55 degrees Fahrenheit minimum day and night during entire joint operation and until building is occupied.

2. Provide ventilation to eliminate excessive moisture.

3. Avoid hot air drafts, which will cause too rapid drying.

PART 2 PRODUCTS

2.1 GYPSUM BOARD

A. Fire Rated

1. Meet requirements of ASTM C 36-85, "Specification for Gypsum Wallboard", Type X, UL one-hour rated.

2. $^{5}/_{8}$ inch thick tapered edge. Face paper suitable for painting.

B. Use water resistant type conforming to requirements of ASTM C 630-985, "Specification for Water-Resistant Gypsum Wallboard" in restrooms, kitchens, and under all ceramic tile.

2.2 METAL ACCESSORIES

A. 26 gauge steel, electrolytic galvanized zinc-coated, treated for maximum cement and paint adhesion. Surfaces to receive bedding cement shall be knurled for maximum bonding.

1. Corner Beads

a. 1-$^{1}/_{8}$ inch leg minimum

2. Casing

a. Channel type

3. Control Joints

a. USG #093

4. Furring Channels

   a. 25 gauge galvanized USG DWC

5. “L” Beads

   a. B4 Series

6. “J” Beads

   a. B9 Series

2.3 JOINT COMPOUND & REINFORCING

A. Best recommended by Wallboard Manufacturer.

2.4 BUGLE HEAD SCREWS

A. Meet requirements of ASTM C 1002-83, "Specification for Steel Drill Screws for Application of Gypsum Board"

1. Type S - For fastening gypsum board to steel framing members.

2. Type W - For fastening gypsum board to wood members.

3. Type G - For fastening gypsum board to gypsum board.

4.

	Metal	Wood	Gypsum	Laminate
	Type S	Type W	Type G	
5.	$^5/_8$" Single Layer	1"	1-$^3/_8$"	None
6.	$^3/_8$" Double Layer Required	1-$^3/_8$"	1-$^1/_2$"	Normal Size
7.	$^1/_2$" Double Layer Required	1-$^3/_8$"	1-$^3/_4$"	Normal Size
8.	$^5/_8$" Double Layer Required	1-$^5/_8$"	2"	Normal Size

PART 3 EXECUTION

3.1 FASTENING

A. Apply from center of wallboard towards ends and edges.

B. Do not apply screws closer than $^3/_8$ inch to ends or edges.

C. Space screws not over 12 inches on center.

D. Adjust power screwdriver to set heads in $^1/_{32}$ inch dimple.

E. Do not break face paper. If face is accidentally broken, apply second screw 2 inches away.

F. Screws on adjacent ends or edges should be opposite each other.

G. Drive screws with shank perpendicular to face of board.

3.2 SINGLE LAYER APPLICATION

A. Apply ceilings first.

B. Use board of size to give minimum number of joints.

C. Apply board at right angles to support. Shim to level.

D. Stagger end joints. End joints shall occur over framing members or be back blocked with 2 inches x 4 inches.

E. Butt edges in moderate contact. Do not force in place.

F. Leave facings true with joint, finishing flush, vertical work plumb, and ceiling surfaces level.

G. Scribe work closely. Keep joints as far from openings as possible. If joints occur near an opening, apply wallboard so vertical joints are centered over openings. No vertical joints shall occur within 8 inches of external corners or openings.

H. After installation, pound on walls and ceilings to detect loose screws. Push on board adjacent to fasteners to detect movement. Tighten loose screws.

3.3 DOUBLE LAYER APPLICATION

A. Apply base layer parallel to studs and attach with appropriate specified screws 8 inches on center at edges and 12 inches on center in field.

B. Apply face layer with joints staggered in relationship to base and occurring over studs. Use combination of adhesive and screws to meet manufacturer's specifications for fire-rated construction.

3.4 METAL TRIM

A. Corner Beads

1. Apply with wallboard nails spaced 6 inches apart maximum.

2. Using metal beads as a screed, cover both flanges with joint compound about 3 to 4 inches wide. Topping or finishing compound is not recommended for first application. Allow 12 to 24 hours or more to dry.

3. Sand lightly if necessary. Apply second coat of joint or topping compound feathering edges 2 to 3 inches beyond preceding coat.

B. Windows & Doors

1. Apply metal edge over gypsum board where it abuts exterior metal window or doorframes. Hold metal trim back from metal window or door frames $^{1}/_{8}$ inch to allow for caulking by Division 07.

C. Trim

1. Apply in accordance with manufacturer's instructions.

D. If partitions have an exposed free end, apply wide-angle tape.

3.5 TAPING

A. Buttering Joints

1. Check screws by drawing finishing knife across surface. Drive home protruding screws, leaving a dimple in wallboard.

2. With broad steel finishing knife, butter joint compound into channel formed by tapered edges of board. Fill channel fully and evenly. Avoid heavy fills.

B. Embedding Tape

1. Center tape reinforcement and press it down into fresh joint compound. Hold knife at approximately 45 degree angle to board and draw along joint with sufficient pressure to remove excess compound. Leave sufficient compound under tape for proper bond but not over $^{1}/_{64}$ inch under feathered edge.

2. Do not use topping or finishing compound for embedding tape.

C. Covering Tape

1. When tape is embedded, apply skim coat of joint compound immediately after embedding to reduce possibility of edge wrinkling or curling, or edge cracking.

2. Allow to dry twelve hours.

D. Spotting Screw Heads

1. Apply first coat of compound over screw heads immediately prior to or after embedding tape. Use pressure on knife to finish compound level with wall surface.

2. Spot screw heads in similar manner during second coat application of compound.

3. During application of third coat over joints, screw heads lightly and apply third finishing coats. "Durite" Screenbak sanding cloth, 320 or 220 grit, is recommended for best results. Allow compound over screw heads to completely dry.

4. Light sanding may be necessary before decoration.

E. Second Coat Application

1. After embedding and covering coat is completely dry, 24 hours under good drying conditions, apply second coat feathered approximately 1-$^1/_2$ inches beyond edges of first coat. Allow to dry.

F. Third Coat Application

1. After second coat is dry, sand lightly. Apply thin "finishing" coat to joints. Feather joint edges 2 inches minimum beyond second coat. Sand lightly when dry.

G. End Joints

1. Treat butt or end joints the same as tapered joints.

2. Fill joint with compound to a point slightly above surface of boards to allow for shrinkage in drying.

3. Apply additional compound along each side of joint and embed tape as described for tapered joints. Apply covering, second, and third coats in same manner as tapered joints.

4. Feather finishing coats of compound wider (approximately 24 inches) as there is no taper in which to embed tape.

H. Finishing Inside Corners

1. Fold tape along center crease. Butter both sides of corner with joint compound and apply tape.

2. Apply second and third coats of compound (one side at a time) in same manner used to finish flat joints.

I. Standards

1. Leave drywall surfaces sanded smooth, free of defects, waves, etc., ready to receive painting.

2. Finish all joints as specified above regardless of type of final finish.

3.6 CLEANING

A. Remove from site all debris connected with this work.

END OF SECTION

SECTION 09265
GLASS FIBER REINFORCED EXTERIOR SHEATHING

PART 1 GENERAL

1.1 Submittals

A. Product Data: Submit manufacturer's descriptive literature indicating material composition, thickness, sizes and fire resistance.

B. Certificates: Submit manufacturer's written certification that product meets specified requirements.

1.2 Quality Assurance

A. Fire-resistance ratings: Where applicable, provide materials and construction that are identical to those of assemblies whose fire-resistance ratings are indicated.

1.3 Delivery, Storage and Handling

A. Delivery: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible.

B. Storage and handling: Store level and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

1.4 Warranty

A. Materials Warranty: Provide sheathing manufacturer's standard warranty covering sheathing materials for five years commencing on date of purchase.

B. Weathering Warranty: Provide sheathing manufacturer's standard warranty covering in-place exposure damage to sheathing for six months commencing on date of purchase by contractor.

PART 2 PRODUCTS

2.1 Sheathing board

A. Acceptable Products:

1. L" Dens-Glass Gold sheathing

2. L" Dens-Glass Gold Fireguard sheathing

B. Characteristics:

1. Size:

a. Dens-Glass Gold sheathing: H" (12.7mm) thick by 4' by 8', 9' or 10' (1.9 lb. per square foot).

b. Dens-Glass Gold Fireguard Sheathing: Nominal L" (15.9mm) thick by 4' by 8', 9' or 10' (2.5 lb. per square foot).

2. Composition:

a. Gypsum sheathing manufactured in accordance with ASTM C 1177 with glass mats both sides and long edges, water-resistant treated core.

3. Fire resistance:

a. Noncombustible when tested in accordance with ASTM E 136.

b. 1/2 or 5/8” " Dens-Glass Gold sheathing: Flame spread 0, smoke developed 0, when tested in accordance with ASTM E 84.

c. 5/8" Dens-Glass Gold Fireguard: Sheathing is rated “Type X” as defined in ASTM C 36 when tested according to ASTM E 119 and can be used as a replacement to any other generic assembly utilizing a 5/8" Type X gypsum board (see GA-600 for numeric assemblies). Dens-Glass Gold Fireguard sheathing is UL classified, Type DGG in UL designs N501, N502, N505, U301, U302, U305, U309, U337, U411, U425, U467, U473, X508, X516.

2.2 Building paper

A. If required by local building code, No. 15, non-perforated, asphalt saturated felt complying with ASTM D 226, Type 1 or equal.

2.3 Accessories

A. Joint tape: 2" wide, 10x10 glass mesh tape.

B. Joint compound: G-P Gypsum setting-type joint compound.

C. Nails, wood framing: Hot dip, 11-gauge galvanized nails with ‡/¡§" head, 1H" min. length.

D. Screws, metal framing:

1. Type S-12, bugle head, self-tapping, rust-resistant, fine thread for heavy-steel gauge (12 to 22).

2. Type S, bugle head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.

E. Screws, metal or wood framing:

1. Wafer head, rust-resistant, Type S-12 drill or Hi-Lo, min. 1" length. Or Type W rust-resistant, bugle head, coarse thread, sharp point for wood.

F. Sealants, caulk and tape:

1. Dow Corning 795 or equivalent; Pecora 895 or equivalent.

2. Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent; Pecora AC-20 acrylic latex sealant; GE Silicone Silpruf Sealant; Tremco Dymonic

3. 2" wide 10 x 10 glass mesh Quick Tape or equivalent

PART 3 EXECUTION

3.1 Preparation

A. Examine subframing; verify that surface of framing and furring members to receive sheathing does not vary more than G" from the place of faces of adjacent members.

3.2 Sheathing

A. Provide Dens-Glass Gold sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253 and ASTM C 1280.

B. Install Dens-Glass Gold sheathing with gold side out.

C. Use maximum lengths possible to minimize number of joints.

D. Wood framing: Attach Dens-Glass Gold sheathing to wood framing with nails spaced 4" o.c. at perimeter for racking shear resistance; 8" o.c. at perimeter where there are framing supports and where racking shear resistance is not required; and 8" o.c. along intermediate framing in field for both conditions.

E. Metal framing: Attach Dens-Glass Gold sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field.

F. Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.

G. Locate fasteners minimum 8" from edges and ends of sheathing panels.

H. Building paper: If required, install building paper or equal with flashing around openings.

I. Finishing:

1. Seal fasteners using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent.

2. Finish joints using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent. Reinforce with 2" wide 10 x 10 glass mesh Quick Tape or equivalent.

3.3 Ceilings and Soffits

A. Joint treatment and finish preparation:

1. Painted ceilings and soffits

a. Apply joint tape over joints and embed in setting-type joint compound specified.

b. Skim coat surface with setting-type joint compound for smooth finish.

c. Prime and paint with exterior grade, good quality paints.

END OF SECTION

SECTION 09512
ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical tiles and concealed suspension systems for ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Evaluation reports.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.
   1. Tile and Suspension Units: Furnish quantity of full-size units equal to 5 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL TILE CEILINGS, GENERAL

A. Acoustical Tile Standard: Comply with ASTM E 1264.

B. Metal Suspension System Standard: Comply with ASTM C 635.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.3 ACOUSTICAL TILES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Fine Fissured or comparable product by one of the following:
CertainTeed Corp.USG Interiors, Inc.; Subsidiary of USG Corporation.

C. Color: As selected from manufacturer's full range.

D. LR: .85.

E. NRC: .55, Type E-400 mounting according to ASTM E 795.

F. CAC: 35.

G. AC: N/A.

H. Edge/Joint Detail: Angular Tegular.

I. Thickness: 5/8 inch.

J. Modular Size: 24 by 48 inches.

2.4 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude 15/16 inch exposed tee or comparable product by one of the following:
1. USG Interiors, Inc.; Subsidiary of USG Corporation.

C. Structural Classification: Intermediate-duty system.

D. Access: Upward.

E. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install acoustical tile ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

C. Arrange directionally patterned acoustical tiles as indicated on reflected ceiling plans.

END OF SECTION 095123

SECTION 09650
RESILIENT FLOORINGS

PART 1 GENERAL

1.1 SCOPE

A. Includes, But is Not Limited To -

1. Furnishing and installing flooring with rubber base where indicated on Drawings.

1.2 STORAGE AND PROTECTION

A. Store materials so as to avoid soiling and damage.

B. Store materials at not less than 70 degrees Fahrenheit for at least 24 hours before using.

1.3 Do not apply in temperatures below 70 degrees Fahrenheit.

1.4 EXECUTION

A. Inspect surfaces for conditions not suitable for first class installation. Remedy cracks and minor irregularities in accordance with Manufacturer's recommendations. Do not start work until defects are corrected.

B. Install flooring in manner to produce smooth, even finished surfaces tightly jointed and accurately aligned in accordance with Manufacturer's recommendations.

1. Fit neatly against projections, piping, electrical service outlets, etc.

2. Leave flooring level, free from buckles, cracks, and projecting edges.

3. Inspect floors, make necessary adjustments within one month after mechanical heat or other heat has been supplied continuously in finished areas.

PART 2 PRODUCTS

2.1 VINYL COMPOSITION TILE

A. Size to be 12 inches x 12 inches x 1/8 inch

B. In conformance with SS-T-312B (1), Type IV, Comp.

C. ASTM E 648 Flame Spread - 75 or less

D. ASTM E 662 NBS Smoke - 450 or less.

E. Approved Products:

1. Excelon Supreme, Armstrong

2. Premiere, Azrock

3. Random Marbles, Kentile

4. Approved Equal

2.2 RUBBER BASE

A. 4 inches height, 1/8 inch gauge

B. Provide cove base over vinyl composition tile, provide toe-less base over carpet.

1. Use preformed external corners.

2. Rolls only - 48 inch strips not acceptable.

3. Approved Manufacturers:

a. Flexco
b. Armstrong
c. Johnson Rubber Company
d. Kentile
e. R.C.A. Rubber Company
f. Roppe Rubber Corporation

2.3 ADHESIVE

A. Water-resistant type. Best grade in accordance with Manufacturer's recommendations.

PART 3 EXECUTION

3.1 Surface to be sound, clean, free from foreign matter, tightly nailed, and dry.

3.2 Fill all cracks, control joints or depressions w/patching material as recommended by flooring manufacturer.

3.3 Tile work shall be centered both ways within each room.

3.4 Install composition edge strips where floor tile abuts adjacent materials.

3.5 Do not begin installation of base until wall finishes are substantially complete.

END OF SECTION

SECTION 09900
PAINTS AND COATINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

1.02 RELATED SECTIONS

A. 05115 Steel Pipe Piles, Marine

B. 05116 Structural Steel

C. 05520 Pipe and Tube Railings

D. 05700 Decorative Metal Fences and Gates

1.03 REFERENCES

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2003.

C. Green Seal Environmental Standards, GS-11, Paints (1993) and GC-03, Anti-Corrosive Paints (1997).

D. The Society for Protective Coatings, SSPC

1.04 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

B. Volatile Organic Compounds (VOCs): Compounds as defined by U.S. Environmental Protection Agency (EPA) in 40 CFR Section 51.100 (s), (s) (1).

C. Aromatic Compounds: Hydrocarbon compounds containing one or more 6-carbon benzene rings in the molecular structure.

D. DFT: Dry Film Thickness

1.05 SUBMITTALS

A. Product Data: Provide data on all finishing products, including VOC content.

B. Manufacturer's Certificate: Certify that products furnished meet or exceed specified requirements.

C. Manufacturer's Instructions: Indicate special surface preparation procedures.

D. Basin Protection Plan: Indicate plan to protect water in the basin from spills or drips if not shop applied.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Application Requirements:

1. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

2. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The design of the project has been based on products manufactured by Tnemec as indicated under "Paint Systems" below.

B. Substitutions must be approved by ODNR and the RPR

2.02 PAINTS AND COATINGS

A. Guide Piles

1. Surface Preparation: SSPC SP6 Commercial blast cleaning

2. Primer: Tnemec Series 90-97, Zinc Rich Primer.

a. 3.0 mils DFT ± 0.5 mils measuring 300 SF per gallon

1. Intermediate Coat: Tnemec Series 161, Epoxy

a. 5 mils DFT ± 1.0 mils measuring 200 SF per gallon

b. Color: Black, matte finish

2. Finish Coat: Tnemec Series 161, Epoxy

a. 5 mils DFT ± 1.0 mils measuring 200 SF per gallon

b. Color: Black, matte finish

B. Metal Handrails and Miscellaneous Metal

1. Surface Preparation: SSPC SP6 Commercial blast cleaning

2. Primer: Tnemec Series 90-97, Zinc Rich Primer.

a. 3.0 mils DFT ± 0.5 mils measuring 300 SF per gallon

3. Intermediate Coat: Tnemec Series 161, Epoxy

a. 5 mils DFT ± 1.0 mils measuring 200 SF per gallon

4. Finish Coat: Tnemec Series 1075, Acrylic Polyurethane

a. 4 mils DFT ± 1.0 mils measuring 300 SF per gallon

b. Spray application only

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Protect surfaces not to be painted and surrounding environment, including harbor basin.

B. Surface preparation for immersed surfaces; SSPC-SP10/NACE 2 Near-White Blast Cleaning.

C. Surface preparation for non immersion service; SSPC-SP6/NACE 3 Commercial Blast Cleaning

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Shop-Primed Steel Surfaces to be Finish Painted:

1. Sand and scrape to remove loose primer and rust.
2. Feather edges to make touch-up patches inconspicuous.
3. Clean surfaces with solvent.
4. Prime bare steel surfaces.
5. Re-prime entire shop-primed item if shop prime does not meet primer specifications.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

3.04 CLEANING

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

END OF SECTION

SECTION 10426
GRAPHICS

PART 1 GENERAL

1.1 SCOPE

A. Provide and install all interior door plaques.

1.2 SUBMITTALS

A. Submit four copies of shop drawings.

B. Submit actual samples of interior plaque.

C. Submit full size rubbing for building plaque.

PART 2 PRODUCTS

2.1 Interior door plaques to be Model No. 200, Type “A” series with Braille lettering by Andco, 8 inches X 8 inches X 1/8 inch. Signs required listed below.

A. Acceptable Manufacturers

1. ASI Sign Systems
2. Diskey Sign Corporation
3. Super Sine
4. Modulex
5. Contemporary Plastics, Inc.
6. Architect Approved Equal

2.2 Schedule of Signs:

Provide signs based on the following. Note that areas listed as “multiple” occur more than once:

A. Men’s Restroom

B. Women’s Restroom

C. Restroom, Unisex

D. Office

E. Laundry

F. Mechanical Room

G. Storage

PART 3 EXECUTION

3.1 INSTALLATION

A. Install signs square and plumb per manufacturers recommendation.

B. Mount door plaques adjacent to strike side of door at 54” A.F.F.

END OF SECTION

SECTION 10440
SIGNAGE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. International Code Council, Ohio Building Code (latest edition).

C. Federal Highway Administration, Manual on Uniform Traffic Control Devices (latest edition).

1.02 SUMMARY

A. Section Includes:
1. Traffic/Road Regulatory Signage.
2. Park Entry Sign.
3. Dock Signage.
4. Fuel Instructions Sign.

B. Related Sections:
1. 04720 Stone Veneered Walls.
2. 09900 Paints and Coatings.
3. Electrical Specifications for Service and Light Fixture

1.03 ACTION SUBMITTALS

A. Complete numbering scheme for all dockage.

B. Shop drawings showing exact copy of layout for all signage.

C. One sample sign of each type, with correct color selection and letter type.

D. Shop drawings and samples of surface applied vinyl letters.

1.04 DELIVERY, STORAGE AND HANDLING

A. Time delivery and installation of signage and post work to avoid extended on –site storage and to avoid delaying work of other trades.

B. All stockpile signage and timbers shall be stacked off the ground, on supports, level with proper ventilation.

C. Keep signage and timbers protected from damage during delivery, storage, handing and fabrications. Any damage or scratches to outer fibers or surface shall not be used and replaced at contractors cost.

PART 2 – PRODUCTS

2.01 TRAFFIC/ROAD REGULATORY SIGNAGE

A. Primary and Secondary Sign Plates: All plates shall be designed in accordance with the Federal Highway Administration, Manual on Uniform Traffic Control Devices (latest edition).

B. Sign Post: Post shall be 2" square, 14 gauge steel post, with 7/16" diameter pre-punched holes, 1" O.C., all sides. Post shall be galvanized, primed and painted black in accordance with Section 09900 – Paints and Coatings. Galvanized steel sleeve shall be set in concrete footing with open bottom to allow for drainage. Sleeve shall extend 4" above top of footing. Sign post shall attach over sleeve with (2) 3/16" stainless steel bolts sized for wind loading in accordance with Ohio Building Codes.

2.02 PARK ENTRY SIGN

A. W Flange Section: Section shall be a W16x26 structural steel W Flange Section. Section shall have laser cut text, Arial font, equally space as indicated on contract drawings. White, frosted acrylics shall be attached to the back side of flange section laser cut lettering. Channel lighting shall be attached to top and bottom of back side of flange section. Section shall have a 3/16" (0.1875) or 7 gauge steel plate, attached via weld to back of flange section to enclose acrylic and channel lighting components. Flange section and steel cover plate exterior shall be primed and painted black in accordance with Section 09900 – Paints and Coatings; interior of box shall be painted white. Section shall have (4) ½" diameter, headed steel studs attached at 4'-0" on center spacing. Limestone block stone shall be cored to accepted headed steel studs. Core holes shall be filled with epoxy material. Place flange section on a ½" bed of non-shrink grout for leveling.

B. Laser Cut Park Logo: Logo shall have a minimum thickness of 3/16" (0.1875) or 7 gauge plate steel. Logo shall be laser cut with all edges sanded smooth. Logo shall have (4) ½" diameter, headed steel studs, attached via weld to the back of plate. Studs shall be equally space for even weight distribution. Logo shall be primed and painted black in accordance with Section 09900 – Paints and Coatings. Artwork shall be provided by Owner in digital format for logo fabrication.

1. Park Entry Sign Pier shall be cored to accept steel headed studs. Once logo is placed, cored holes shall be filled with an epoxy material. Use stop material as needed to prevent excess epoxy from damaging stone veneer.

2. Once epoxy is dry, remove stop material and install remaining stone veneer in same manner as others with no evidence of difference.

3. Fasteners: Hardware shall be sized for wind loading in accordance with Ohio Building Codes. Hardware shall be stainless steel tamper resistant screws.

2.03 DOCK SIGNAGE

A. Aluminum Plate Signs shall have a minimum thickness of .125 inches.

B. Plate shall be coated with acrylic polyurethane reflective paint (White).

C. Copy shall be reflective black vinyl, pressure sensitive and die cut (Helvetica Bold); Size as shown on contract drawings.

D. Fasteners: Hardware shall be sized for wind loading in accordance with Ohio Building Codes. Hardware shall be stainless steel tamper resistant screws.

2.04 FUEL INSTRUCTIONS SIGN

A. Aluminum Plate Signs shall have a minimum thickness of .125 inches.

B. Plate shall be coated with acrylic polyurethane reflective paint (White).

C. Copy shall be reflective red vinyl, pressure sensitive and die cut (Helvetica Bold). Size as shown on contract drawings.

D. Sign post shall be 3/16” (0.1875) or 7 gauge, 2” square tube steel. Post shall be attached to a ½”, 6” square plate via weld. Top of post shall be capped. Sign post and plate components shall be primed and painted white in accordance with Section 09900 – Paints and Coatings.

E. Fasteners: Hardware shall be sized for wind loading in accordance with Ohio Building Codes. Hardware shall be stainless steel tamper resistant screws.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Signs shall be provided as shown on the drawings.

B. Care shall be taken in all sign installations to prevent scratching, chipping, etc., and to install the signs neatly in a workmanlike manner. Any installed signs not meeting these requirements shall be removed and replaced.

C. Dock Signage shall be installed square to the dock edges.

3.02 REPAIRING AND CLEANING

A. Replace any posts or signage that is chipped, scratched, broken, stained or otherwise damaged or that do not match other materials. Provide new material and install in same manner as others with no evidence of replacement.

B. Replace any stone veneered material that is stained or damaged because of excess epoxy. Provide new material and install in same manner as others with no evidence of replacement.

C. Cleaning: Remove excess epoxy material from exposed surface; wash and scrub clean.

END OF SECTION

SECTION 10522
BUILDING FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.2 RELATED SECTIONS

A. Section 06100 – Rough Carpentry.

1.3 REFERENCES

A. NFPA 10 - Standard for Portable Fire Extinguishers.

B. UL - Fire Protection Equipment Directory.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10 and applicable code.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.5 SUBMITTALS FOR REVIEW

A. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

1.6 SUBMITTALS FOR INFORMATION

A. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

B. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

A. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Larsens, (612) 571-1181, Model C2409-R full glass door, MP-10 extinguisher.

2. Potter-Roemer, (800) 762-0542.

3. J.L. Industries, Inc., (612) 835-6850.

4. Approved equal.

2.2 FIRE EXTINGUISHERS

A. Dry Chemical Type: Cast steel tank, with pressure gage; Class B: Size 10.

B. Extinguisher Finish: Steel enamel to color as selected.

2.3 FIRE EXTINGUISHER CABINETS

A. Metal: Formed aluminum.

B. Trim Type: Flat with 5/16 inch projection wide face.

C. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch.

D. Door Glazing: Plastic, clear, 1/8 inch thick acrylic.

E. Cabinet Mounting Hardware: Appropriate to cabinet.

F. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

G. Pre-drill for anchors.

H. Hinge doors for 180 degree opening with two butt continuous piano hinge. Provide nylon catch.

I. Weld, fill, and grind components smooth.

J. Glaze doors with resilient channel gasket glazing.

K. Finishing Cabinet Exterior Trim and Door: Satin chrome No. 4 finish.

L. Finishing Cabinet Interior: Enamel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 36 inches from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

END OF SECTION

SECTION 10800
TOILET AND BATHROOM ACCESSORIES

PART 1 GENERAL

1.1 SCOPE

A. Furnish items listed below for each restroom complete with proper attaching devices in location and mounting heights depicted on drawings.

1.2 SUBMITTALS

A. Submit schedule showing items used, location where installed, and conformance with Contract Documents.

B. Submit four (4) sets of shop drawings.

PART 2 PRODUCTS

2.1 The following are Bobrick Washroom Equipment model numbers except the hand dryers.

A. ADA Grab Bars – B-5806 x 36” and 42”, Concealed mtg., Snap Flange, Satin Finish.

B. Diaper Changing Station – B-2210

C. Mirrors – B-165-1836

D. Hand Dryers – Xlerator Hand Dryer, Model XL-W

2.2 APPROVED EQUAL

A. G. M. Ketcham Company, Inc., Paterson, N.J.

B. American Specialties, Inc., Yonkers, N.Y.

C. Bradley Corp., Mount Laurel, N.J.

D. McKinney Manufacturing Co., Scranton, PA

PART 3 EXECUTION

3.1 Install items in accordance with manufacturer's instructions. Provide mounting devices proper for base structure.

3.2 Where possible, mount like items in adjoining compartments back-to-back on same partition.

3.3 Provide solid wood blocking for mounting all accessories (in stud walls).

END OF SECTION

SECTION 10950
MISCELLANEOUS BUILDING SPECIALTIES

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install all miscellaneous products listed herein.

B. Refer to plans for quantities and locations.

1.2 SUBMITTALS

A. Submit four (4) sets of shop drawings and manufacturer's product literature.

PART 2 - PRODUCTS

2.1 Folding Stairway attic access ladder. “Precision Ladders, LLC, SS/AL-12”. Distributed by B.L. Wilcox & Associates, 1(562)693-2787.

2.2 Louvers

2.3 Fiberglass columns. Arndt & Herman, unfluted 12" diameter. Tuscan Order Base and Capital. 1-866-204-3139.

END OF SECTION

SECTION 11850
NAVIGATION AIDS

PART ONE - GENERAL

1.01 SECTION INCLUDES

A. Materials, labor, services and incidentals necessary for completion of this section of the work, including supply and installation of navigation lights and day markers.

1.02 SUBMITTALS

A. Submit shop drawings under provisions of General Conditions.

B. Submit product data under provision of General Conditions.

C. Submit product data for all navigation aid equipment.

D. Submit manufacturer's installation instructions under provisions of General Conditions.

1.03 PROJECT RECORD DOCUMENTS

A. Submit record document under provisions of General Conditions.

1.04 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of General Conditions.

1.05 WARRANTY

A. Warrant lanterns, flasher/lamp changer, battery, control systems and workmanship for a period of two years from the date of acceptance under the provisions of General Conditions.

1.06 SAFETY CODES AND STANDARDS

A. Navigation aids shall be installed to meet the requirements of the U.S. Coast Guard and other applicable Federal, State and Local standards.

B. While construction is underway and before proposed navigation aid system is put into service, provide adequate temporary navigation aids to the approval of the Contracting Officer, Harbor Engineer, and U.S. Coast Guard.

PART TWO - PRODUCTS

2.01 MANUFACTURERS

A. Tideland Signal Corporation

B. Carmanah

C. Substitutions: Under provisions of General Conditions.

2.02 MATERIALS

A. General

1. All navigation aids shall be manufactured to meet the requirements of the U.S. Coast Guard and other applicable federal, state and local standards.

2.03 PRODUCTS

A. Navigation Aid: Shall be Tideland SolaMAX-155 Self-Contained Marine LED Lantern Assembly P.N. 010.1169-SA Includes high intensity MaxiHalo-60, flasher controller preset to 10% input power, 6-solar panel, rechargeable batteries and 3-bolt mounting hardware. Externally programmable with optional signal view programming kit. This self-contained marine lantern is USCG approved for Class C structures.

B. Pole Mount: Navigation Aid shall be mounted 7-ft. high as shown on the drawing.

C. All exposed surfaces of the light structures shall be painted with two coats of “Z.R.C.” as manufactured by Sealube Company, Quincy, Massachusetts or approved equal, applied in accordance with manufacturer’s directions. Color to match grey on light. Owner shall approve color sample.

PART THREE - EXECUTION

3.01 EXAMINATION

A. Verify connection at wave attenuator is designed to accommodate navigation aid.

3.02 PERFORMANCE

A. Navigation light shall be controlled automatically by an adjustable light sensing device which shall activate the lights during hours of darkness and deactivate the lights during hours of daylight.

3.03 INSTALLATION

A. Navigation Aids

1. Install as shown on Drawings and in accordance with manufacturers suggested installation instructions.

2. Elevation of the luminaire shall be as shown on the drawing.

3.04 START-UP

A. Provide Factory Representative to aid in start-up of navigation aids such that it meets to approval of the U.S. Coast Guard.

END OF SECTION

SECTION 13120
PREFABRICATED METAL BUILDINGS

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 02488 - Floating Docks, Bridges, and Ramps

B. Division 16 - Electrical: Electrical power service supply and connections.

1.02 REFERENCES

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures

C. NFPA 70 - National Electric Code

D. IBC - International Building Code

1.03 DESIGN REQUIREMENTS

A. Provide factory built, prefabricated structure capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

B. Live Loads: Floor 50 PSF, roof 50 PSF, wind 120 MPH (minimum of 20 psf wind load for all exterior components).

C. Thermal Movements: Provide factory built, prefabricated structure that allows for thermal movements resulting from the maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

D. Building fabricator shall coordinate with floating dock manufacturer to ensure building and dock design is coordinated. Building frame must be designed with adequate rigidity in relationship to the dock frame stiffness to ensure long term building durability.

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

2. Preparation instructions and recommendations.

3. Storage and handling requirements and recommendations.

4. Installation methods.

B. Shop Drawings: Include plans, elevations, sections, details, electric schedule and attachments to other work.

C. Selection Samples: For each finish product specified, two complete sets of color samples representing manufacturer's full range of available colors and patterns.

D. Certificates: Product certificates signed by the manufacturer certifying material compliance with specified performance characteristics and criteria, and physical requirements.

E. Furnish an affidavit stamped and signed by a professional engineer certifying that the building design meets the applicable building codes and the design requirements specified herein.

F. Warranty documents specified herein.

1.05 REFERENCES

A. Prefabricated building manufacturer shall provide location and references for three similar buildings that have been in service more than three years so that the engineer can inspect on site and obtain a statement from the owners on the quality of workmanship (fit and finish).

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing prefabricated structures and shelters with a minimum documented experience of ten years and with a quality assurance program utilizing independent third party quality control inspections.

B. Pre-installation Meetings: Conduct meetings to verify project requirements, dockage attachment criteria, utility connections, manufacturer's installation instructions, and warranty requirements.

1.07 WARRANTY

A. Provide manufacturer's warrantees on all accessory items provided such as, but not limited to, air conditioning, lights, and heating units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers capable of meeting or exceeding the building specifications will be considered for approval.

a) B.I.G. Enterprises
9702 East Rush Street
South El Monte, CA 91733,
Phone: (626) 448-1449, website: www.bigbooth.com

b) Par-Kut International, Inc.
40961 Production Drive
Harrison Township, MI 48045
Phone: (586) 468-2947, website: www.parkut.com

c) Ameristar Booth & Building Structures
1555 N. Mingo Rd
Tulsa, OK 74116

Phone: (855) 526-6847, website: http://ameristarbooths.com/

2.02 PREFABRICATED STEEL BUILDINGS

A. Structure: 6' x 8' Prefabricated booth shall include hip style roof, colonial style window mullions, exterior crown molding and architectural wall treatment. Exterior walls shall include a raised rib architectural reveal and base trim. All welded joints to be ground smooth. Aluminum or fiberglass construction not acceptable. Building to be shipped completely assembled. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.

B. Wall Panels: Shall be single unit welded steel construction structural steel tubing. Galvanized steel wall panels shall be a minimum of 14 ga. exterior and 18 ga.interior with insulated core.

C. Base/Floor: Floor shall consist of galvanized steel plate covered with square black rubber tiles and 4" base cove over a steel tube frame.

D. Interior Ceiling Panels: Painted galvanized steel panels.

E. Height: Interior floor to ceiling height 88 inches minimum.

F. Finish: All interior and exterior steel surfaces except rooftop and floor shall be painted with High Performance, Rust Inhibitive, Polyurethane paint. Overall system shall have a minimum 5 mil rating. Owner will select one color for the roof and a second color for the walls from the manufacturer's color selection charts. All seams and joints shall be fully bonded and all openings shall be fully weather stripped. Underside of floor shall be painted or bituminous coated.

G. Doors: Shall be heavy duty steel framed sliding door top suspended on steel no-maintenance ball-bearing rollers in a steel track. Door shall be half glass with tempered glazing. Provide heavy duty stainless steel hardware, keyed lock, and weather-stripping.

H. Windows: Shall have a galvanized steel frame primed and finish painted to match building. Windows shall be constructed in a decorative colonial style. Provide fixed windows with a sliding window opposite the door. Slider shall have locking device and stainless steel insect screen. Windows shall be squared and weather-sealed at the factory.

I. Glazing: Dual pane, insulated, tinted, tempered safety glass.

J. Roof: Standing seam roofing material shall be 24 ga minimum galvanized steel with Kynar 500 baked finish (or equal). Provide 6:12 minimum pitch. Hip roof shall have ridge cap covers. Provide 8" overhang with a decorative crown molding under the overhang. Fascia height shall be 4" minimum.

K. Roof Type: Standing Seam Hip.

L. Roof Overhang: As indicated on drawings.

M. Insulation: Walls shall be insulated with rigid fiberglass board. Roof structure shall be fully insulated. Floor shall be insulated.

N. Work Counter: One 22" deep (min.) counter full width of the booth. Provide a drawer under counter with minimum dimensions of 18" wide, 18" deep and 5" tall on ball bearing rollers for

smooth operation. Drawer shall include keyed lock. Counter shall include three cord drop access holes.

O. Electrical: Provide a U.L. approved system wired to N.E.C. standards with heater/ac unit, ceiling mounted dual bulb fluorescent light fixtures, and 3 GFCI duplex receptacles. Provide 3 exterior flood lights operated on separate switch from interior lights. Flood lights shall be commercial/industrial grade LED or fluorescent lights. Provide 125 amp, 120/240 VAC, three wire, single-phase load center. Unit shall be delivered with all wiring complete. Building shall be delivered to site ready for connection.

P. Phone/Cable: Provide phone and cable jacks under the work counter with conduit runs to the stub area.

Q. Climate Control: Supply a through wall combination heater/air conditioning unit of appropriate capacity for the size and thermal efficiency of this unit. Unit shall have integral thermostat. Heating capacity shall be sized to maintain 45-degrees during the winter for the electronic equipment. Building occupancy is not expected during the winter.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine dock structure (foundation) for compliance with manufacturer's requirements, including installation tolerances and other conditions affecting performance of supporting members.

B. Verify that bearing surfaces are ready to receive the work.

C. Verify the rough-in location of required electrical services prior to placement of the structure.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.

C. Place on prepared dock superstructure or concrete panels.

D. Anchor securely in place with stainless steel anchor bolts in accordance with building and dock manufacturer’s instructions.

E. Connect electrical services as specified in Division 16.

3.04 PROTECTION

A. Protect installed building during construction and touch-up, repair or replace any products damaged before Substantial Completion.

END OF SECTION

SECTION 13215
FUEL STORAGE TANK FLOAT

PART ONE- GENERAL

1.01 SUMMARY

A. This section addresses the design-build fuel storage tank float (permanently moored fuel barge) to be built as part of the new fuel system. A single barge/float shall contain one 2,000 gallon gasoline Steel Tank Institute FIREGAURD Standard for double-wall, fire protected, above ground fuel storage tank. Contractor shall employ a Naval Architect or licensed Professional Engineer experienced in fuel barge design to engineer the barge to meet project requirements and applicable Codes and Regulations.

B. The barge is to be designed to have containment sumps for detection of leakage without any loss to the environment. The barge design will need to accommodate an integral product and water leak detection system, and an alarm system.

C. Related Sections include:

1. Section 09900 – Paints and Coatings
2. Section 15450 – Fuel Distribution System
3. Section 02488 – Floating Docks, Bridges, and Gangways

1.02 REFERENCES

A. National Fire Protection Association NFPA 30 Flammable and Combustible Liquids Code

B. NFPA 30A Motor Fuel Dispensing Facilities and Repair Garages

C. NFPA 303 Fire Protection Standard for Marinas and Boatyards

D. Ohio Department of Commerce- Division of State Fire Marshall

E. Ohio Building Code

1.03 SYSTEM DESCRIPTION

A. The fuel barge is to be the float to support and contain the doublewall above ground fuel storage tanks. The base is to be located adjacent to the administration building floating platform. The design of the barge is to be coordinated with the fuel system supplier to facilitate a total system capable of functioning during normal operations and capable of withstanding the effects of flood conditions on the reservoir.

B. The fuel barge shall be delivered ready to accommodate fittings for the piping, control systems, sumps, pumps, and accessories associated with the fuel system.

C. The barge shall be designed to fully support and contain the 2,000 gallon gasoline fuel storage tank, ballast, and removable cover. The barge, when installed in-place with removable cover shall fully contain the fuel tanks so that on the surface of the cover only

the tank manway tops and penetrations for product delivery lines, vents, and instrumentation are exposed.

D. The barge and removable cover shall be fully coated per Section 09900, Paints and Coatings.

E. The barge shall be designed to include anchorage or stiff arm connection to dockage for all water elevation conditions in accordance with Section 2.02.

1.04 SUBMITTALS

A. Shop Drawings: Contractor shall submit four copies of shop drawings for the barge. Drawings shall include all critical dimensions and show locations of all fittings and accessories, i.e., manways, ladders, cover, tank connections, vents, etc. Materials of construction shall be in accordance with Section 1.02 of this specification.

1. Include on shop drawings all information necessary for the fabrication of component parts of the structure. Indicate size of members, type and location of shop and field connections and the type, size and extent of all welds.

2. The following is a partial listing of details required for submittal:

a) Plan View: Layout should indicate location of all joints, framing connections, cover layout, anchorage system, and all other barge amenities.

b) Typical sections and elevations

c) Details of anchorage system

3. All detail drawings shall be accurately and completely dimensioned. Drawings shall indicate all relevant sizes and shall show thicknesses, gauges, finishes, materials, etc., of all items shown.

4. All shop drawings shall include the statement “The structural details and the performance of the system under design loadings are in complete conformance with the design criteria,” and are stamped with the seal of a Licensed Professional Engineer experienced in this type of design.

5. Prior to final payment, submit three copies of as-built drawings, including location of anchorage system, to the Owner.

B. Design calculations: Provide certified calculations by a licensed PE licensed in the State of Ohio experienced in barge design for the barge, cover, tank attachment, and barge anchorage.

C. Furnish an Operations and Maintenance Manual for the barge system covering incorporated materials and systems. Operations Manual shall include equipment and personnel requirements associated with installation and operation (where relevant) of the barge system and recommended annual and periodic inspection and maintenance requirements recommended by the manufacturer to maximize the service life of the

system.

1.05 GUARANTEE

A. The Contractor shall execute and deliver to the Owner, before final payment, a written guarantee of form satisfactory to the Owner. The guarantee shall state that all labor and materials (including barge and all associated work) furnished by the Contractor are in accordance with the contract plans and specifications, and authorized alterations and additions thereto; and that, should any defect develop during the contract guarantee period as hereinafter defined, due to improper materials, workmanship, arrangement or design, those defects be corrected by the Contractor without expense to the Owner.

PART TWO - PRODUCTS

2.01 DESIGN CONDITIONS

A. Caesar Creek Lake is subject to floods, floating ice, and current. Barge shall be designed to withstand the expected environmental loads without damage. Design velocity for the lake current is 2 fps.

B. The barge shall be permanently moored to the adjacent, but not connected to the floating docks and building platform. Utility attachments from the barge to the platform must be capable of transmitting design loads to the docks without damage.

C. Barge shall be compliant with applicable State of Ohio and Coast Guard regulations.

D. Barge must be vented. Barge shall be designed for operation at atmospheric pressure.

E. Barge shall be chemically inert to petroleum products.

F. Barge shall have an integrally mounted sump installed for product and hydrostatic monitoring.

G. Ladders - Ladders shall be the standard ladder supplied by the barge manufacturer.

2.02 PERFORMANCE

A. Final configuration, support structure and flotation requirements are the responsibility of the barge vendor. The barge configuration on the drawings is based upon the following assumptions and criteria.

1. Vertical

a. Dead load shall be the entire weight of the barge including dead access ramps, fuel tanks fully loaded, barge cover and appurtenances.

b. Live load for flotation calculations shall be not less than 50 pounds/square foot (PSF) for barge.

c. Barge at dead loading in the water shall maintain a free board of 24 inches. Design of free board shall be indicated in the shop drawings. The free board on the overall barge system shall not vary more than 1 inch from the approved drawings. At the design load of dead load plus 50 PSF live load, a free board of not less than 18 inches shall be maintained. Configuration of flotation shall compensate for unbalanced fuel tank loading conditions.

d. Structural members and deck surfaces and cover shall be designed with a uniform live load of 50 PSF. Maximum deflection under live and dead loading shall be 1/240 of the span. Maximum deflection under live loading shall be 1/360 of span.

2. Horizontal

a. Uniform wind load perpendicular to the barge; assume to be full wind on projected elevation (16 PSF).

b. The structure and system shall be designed to withstand a 1.5 foot wave conditions on a continuous basis.

c. The structure and system shall be designed to withstand the following storm conditions on a 4 hour periodic, but not continual:

1. Wave: 3.5 ft
2. Current: 2 ft/sec.

d. Positively prevent torsion, racking and twisting by providing sufficient built-in torsional resistance.

3. Anchorage shall be per 02488 for floating dockage.

PART THREE - EXECUTION

3.01 WORKMANSHIP

A. All workmanship shall be first class in all respects and any units not representing a finished and acceptable appearance will be rejected.

B. All finished steel members shall be free from twists, bends, distortions and open joints. All steel construction shall be free of sharp edges and burrs. Ends of exposed steel members shall be rounded or beveled. All coping and mitering shall be done with care. Projecting materials and burrs that would prevent bearing of the various members on each other shall be removed.

C. All drilling and cutting of steel done after coating (if approved by the Owner) shall be field relocated per Section 09900, Paints and Coatings.

D. All welding shall conform to the requirements of the American Welding Society. Welds shall be a solid and homogeneous part of the metals joined and shall be free from pits or scale, and shall be of full areas and length required to develop the required strength for the intended use.

E. All bolts, nuts and washers shall be set square with connecting structural members and the nuts shall be drawn up tight. Lock washers or other devices or techniques shall be used to prevent nuts from loosening after being properly tightened.

3.02 INSTALLATION AND TESTING

A. Barge shall be tested and installed according to the current regulatory requirements and documented in standard test reporting format.

3.03 WARRANTIES

A. Barge shall be warranted to be free from material defects in workmanship and materials for a period of one (1) year following date of acceptance.
B. The sump shall be warranted for 30 years against failure due to internal/external corrosion and when properly installed, against structural failure.

END OF SECTION

SECTION 13220
ABOVEGROUND FUEL TANK

PART ONE GENERAL

1.1 SUMMARY

A. This section addresses the 2000 gallon Aboveground Storage Tank (AST).

B. Related Sections include:

1. Section 15450 Fuel Distribution System

2. Section 13215 Fuel Storage Tank Float

1.2 REFERENCES

A. (National Fire Protection Association) NFPA 30 Flammable and Combustible Liquids Code

B. NFPA 30A Motor Fuel Dispensing Facilities and Repair Garages

C. NFPA 303 Fire Protection Standard for Marinas and Boatyards

D. UL Underwriters Laboratories, Inc. UL-2085

E. Ohio Fire Code (OFC)

F. PEI/RP 1000-09:" Recommended Practices for the Installation of Marina Fueling Systems"

G. NEC Article 555 Marinas and Boat Yards

H. PEI/RP 200-08:" Recommended Practices for the Installation of Aboveground Storage Systems for Vehicle Fueling"

1.3 SYSTEM DESCRIPTION

A. 2000 Gallon Tank shall be located on the Fuel Storage Tank Float and include all associated piping, monitoring equipment, and appurtenances.

1.4 SUBMITTALS

A. Shop Drawings: Contractors shall submit four copies of shop drawings for each tank. Drawings shall include all critical dimensions and show locations of all fittings and accessories, i.e., manways, ladders, hold-down straps, etc. Materials of construction shall be in accordance with Section 1.02 of this specification.

B. Catalog Data: Contractor shall submit four copies of manufacturer's literature.

C. Certification Plate: UL labels shall be affixed to each tank.

D. Installation Instructions: Contractors shall submit four copies of manufacturer's latest installation instruction.

E. Calibration Charts: Contractors all submit copies of manufacturer's latest calibration charts.

PART TWO PRODUCTS

2.1 ABOVE GROUND STORAGE TANKS

A. Fabricate tanks from According to the Steel Tank Institute Fireguard standard for double wall, Fire Protected Aboveground Storage Tanks and meet all requirements of Ohio State Fire Marshall, listed for Underwriters Laboratories UL 142 or ULC 601, ULC S630 or ULC C142.18
B. Tank shall be double-wall with a steel inner wall for primary containment and provide integral secondary containment by an impervious steel outer wall. Tank shall have 360 degree double-wall construction.
C. Tanks shall have space between the primary and second shell walls to allow free flow and containment of all leaks. Interstitial space shall be constructed to allow continuous monitoring of the entire interstice for the life of the tank. The tank shall have an internal monitoring pipe for the interstitial space. An interstitial leak sensor (float switch) shall be supplied and installed within the interstitial monitoring tube by the tank manufacturer. Sensor assembly shall be hermetically-sealed to prevent moisture or contamination from entering the interstitial space. Lead wires shall be provided to allow connection to the site's monitoring panel. Integral secondary containment shall be testable and provide access for interstitial leak detection monitoring.

D. Manufacturer shall be a licensed member company of the Steel Tank Institute and subject to Steel Tank Institute's Quality Assurance program.

E. Provide double-wall, horizontal, cylindrical, steel, aboveground storage tanks with flat heads and saddle supports.

F. Tank shall be double-wall with a steel inner wall for primary containment and provide integral secondary containment by an impervious steel outer wall.

G. Interstitial Space: Tanks shall have space between the primary and second shell walls to allow free flow and containment of all leaks. Interstitial space shall be constructed to allow continuous monitoring of the entire interstice for the life of the tank. The tank shall have an internal monitoring pipe for the interstitial space.

H. An interstitial leak sensor (float switch) shall be supplied and installed within the interstitial monitoring tube by the tank manufacturer. Sensor assembly shall be hermetically-sealed to prevent moisture or contamination from entering the interstitial space. Lead wires shall be provided to allow connection to the site's monitoring panel.

I. Integral secondary containment shall be testable and provide access for interstitial leak detection monitoring.

J. The Contractor is responsible to confirm that all products provided and installed are compatible with the product being stored.

K. Clean interior and exterior prior to painting. Remove mill scale, dirt, rust, oil, welding debris, loose coatings and coatings incompatible with fuel stored or protective coatings. Exterior cleaning to be by means of sandblasting to a commercial grit blast (SSPC-6)

L. Provide coating of rust resistant epoxy primer on non-fuel side of steel tanks. Additionally, provide two coats of fuel resistant polyurethane finish coating on all exposed surfaces and fittings of the external tank. Primer and paint mil thicknesses to be per STI – FIREGUARD® specifications.

M. Exterior color to be white.

N. Must be compatible with the product to be stored.

a. Each tank shall include:

i. All-welded steel interior and exterior tank.

ii. Horizontal, double containment, atmospheric tank for above ground installation.

iii. Entire unit factory-fabricated including steel supports.

iv. Provide tank supports which can be anchored to a floating dock.

v. All necessary threaded bungs welded along the top of the vessel for equipment to be installed in each tank.

vi. Flanged bungs welded along the top of the vessel for the primary and secondary emergency vents must be used.

vii. Factory installed lifting lugs integrally manufactured onto the tank by the manufacturer (Minimum of 2)

viii. Tank support b-skids shall be welded to the tanks with a wear plate between the tank and the tank skid consisting of a minimum, ¼” carbon steel plate. (Minimum of 2)

ix. Coordinate tank support locations with designer of floating barge.

2.2 Tank Vents:

A. Normal Vent: 2" threaded inlet, 8 oz./sq. in. (pressure), 1oz./sq. in. (vacuum) normal pressure/ vacuum vent for “normal” venting of aboveground storage tanks. Allows tank to “breathe” during filling and discharging operations. Pressure/vacuum poppets seal vapors in the tank when pressure is equalized.

i. Aluminum hood and body construction including brass raised metal seats/poppets, threaded gauge hatch for manual gauging access and horizontal discharge with field-adjustable, tripolar orientation.

ii. Must be compatible with the product to be stored.

iii. Quantity of (1) per tank.

iv. Acceptable Manufacturers: Morrison Brothers Co., OPW Fueling Components or The Protectoseal Company.

B. Emergency Relief Vents for Fire Exposure: Venting capacity shall conform to NFPA 30 or 31 as applicable. Provide separate vents for primary or secondary tanks. 6” threaded inlet, 8 oz./sq. in. emergency vent that consists of a body and a black cover that moves up and down on a center pin. Pressure inside the tank forces the cover to lift up off the vent seat, allowing air to exhaust. The center pin guides the movement. When pressure falls the cover lowers back down onto seat and the vent is automatically reset.

i. Aluminum body and ductile iron cover construction including Viton o-ring seals.

ii. Must be compatible with the product to be stored.

iii. Quantity of (2) per tank.

iv. Acceptable Manufacturers: Morrison Brothers Co., OPW Fueling Components, The Protectoseal Company or equal.

2.3 Tank Gauge:

A. 2” clock style gauge for measuring liquid level in the aboveground storage tanks. Gauge mounts on top of tank and is activated by a float connected to a cable. Readout is on a 12 hour clock face.

i. Aluminum body, stainless steel float and cable construction with 2” NPT male connection. Float fits through a 2" schedule 40 and 80 pipe nipple.

ii. Swivel 360° for desired orientation.

iii. High level/low level decals for application on lens cover.

iv. Must be compatible with the product to be stored.

v. Quantity of (1) per tank.

vi. Acceptable Manufacturers: Morrison Brothers Co., OPW Fueling Components or equal

2.4 Tank Accessories:

A. Tank Labeling: Each shall include labels on all sides of the tank to comply with fire code regulations. Such labeling shall be visible within 20 feet of the tank. The labeling shall include, but not be limited to 'FLAMMABLE", NO SMOKING" and product identification for the contents contained within.

i. Lettering shall be a minimum of 4" tall.

ii. The lettering shall be white in color on a red background.

iii. Labeling shall be on all 4 sides of the tank.

iv. NFPA hazard decal with numbers for each product.

B. Fill pipe tags: Each shall include labels on all sides of the tank to comply with fire code regulations. Such labeling shall include product identification at the fill tubes along with ID tags for the overfill prevention devices. Such tags shall be affixed to fix pipe of each tank.

2.5 Tank Monitor:

A. The Contractor shall provide a tank monitor system that has integral interstice and sump monitoring capabilities. The tank monitoring system shall meet all of the applicable performance specifications and regulatory agency requirements set forth by the following organizations: American Petroleum Institute (API), American Society for Testing and Materials (ASTM), Environmental Protection Agency (EPA), Federal Communications Commission (FCC), National Electric Code (NEC) National Fire Protection Agency (NFPA), Underground Storage Tank: Subpart D, 40 CFR Part 280 and Underwriters Laboratories (UL).

B. The tank monitoring system readout shall be located in the Marina Administration building office and compatible with ODNR systems.

C. The controller shall be microprocessor-based, and shall be designed and constructed with modular architecture easily permitting either factory or field upgrades and servicing. Configuration and set-up data shall be maintained in non-volatile memory having minimum fifty (50) year data retention without requiring power of any kind. Replacement or substitution of any controller plug-in card shall not require system re-configuration. Real-Time clock and non-critical log data, such as inventory, delivery, alarm, theft, error, and leak reports shall be maintained in battery backed non-volatile memory with a minimum data retention of from (5)-(10) years in the event of a power outage.

D. System shall include digital display for viewing tank information and LED indicators for

the alarm conditions.

E. System shall have the capability to continuously monitor up to two (2) dual-float magnetostrictive in-tank level probes and up to eight (8) secondary containment leak or point-level sensors. Leak and point-level sensor inputs shall support a means to detect sensor open-circuit and short-circuit wiring faults as a standard feature when used in conjunction with fault-reporting sensors. The system shall provide hardcopy 24 column environmental compliance reports, which exit the front panel or are stored internally with optional autowinder take-up spool.

F. The RS-232 serial port shall be standard for communications with a local PC computer.

G. Provide INFORM software single site PC software. Part# 848940-010

H. Ethernet network interface shall be available for LAN/WAN connections.

I. Output card shall be available to provide 0-20ma/4-20ma/0-24ma/0-1ma signals for tank-related real-time data.

J. System shall operate on 115 VAC, 50/60 Hz.

K. The console shall be wall mounted with printer and autowinder. This shall be mounted in the Marina Administration building, exact location to be determined by owner.

L. The console shall include microprocessor board probe/sensor card, power supply, control I/O and communications interfaces.

M. Front panel display shall include audible and visual alarms, user-friendly membrane pushbutton controls, and printer.

N. The display shall be nine digit, seven segment, quasi-alphanumeric sunlight readable LED type, with LED alarm annunciators for three (3) alarm conditions; leak, five (5) tank product set points, and one water float per tank. LED alarm lights shall be visible from at least 60 feet and the seven-segment display data shall be readable from no less than twenty (20) feet. Displays shall include product gross or net, percent of capacity, 90/95/100% ullage, product and water level, product temperature, and product type. As a standard, two (2) programmable relay outputs and two (2) contact closure inputs shall be provided. The system shall provide hardcopy environmental compliance and status reports via front panel 24-column printer and annunciator panels.

O. Tank Gauging Probe: The Contractor shall provide one level & water indicating probe for each tank. The probes shall be designed for both AST and UST applications and shall have performance characteristics permitting 0.1 GPH or better in-tank leak test with continuous gauging accuracy of +/- 0.0005 inches for product, +/- 0.001 for water and +/-

0.001 degrees F for (relative) temperature. Probe shall contain an array of at least five (5) temperature sensors along its length for accurate volumetric temperature compensation. Probe to console communication shall employ digital transmission techniques carried over standard, readily available two-conductor, shielded cable, with a maximum cable length restriction of no less than 4000 feet. Probe operating temperature and pressure shall be -40 to +175 degrees F and 150 PSIG respectively. Probes shall be supplied with product float, water float, and six (6) foot leader cable with watertight connector, and centering rings for riser mounted applications. Probe shall be UL/CSA approved for use in Class I, Division I, Group C & D hazardous locations.

i. Quantity of (1) probe per tank.

ii. Must be compatible with the product to be stored.

P. Discriminating Type Liquid Sensors: The Contractor shall provide liquid sensors for all double-wall tank interstices, pipeline transition sumps and dispenser sumps. Designed for required locations. Sensing points shall be at the lowest point. Sensors shall be of an intrinsically safe design. Such sensors shall be a 2-wire type consisting of a magnetic, Buna-N float encased within a 1-1/2 inch diameter, stainless steel outer housing and supplied with twenty-five (25) feet of 2-conductor #22 AWG gage wire. Sensor shall be rated to 50 PSIG at 160F with an accuracy of 1/2-inch of liquid. Optional configuration utilizing 1-3/4 inch diameter stainless steel/Teflon housing, stainless steel float and Teflon-jacketed cable shall be available for solvent/fuel additive applications. Sensors shall be available with wiring fault detection option.

i. Quantity of (1) per tank interstice(s).
ii. Quantity of (1) per transition sump(s).
iii. Quantity of (1) per inline transition sump(s).
iv. Quantity of (1) per dispenser sump(s)

Q. The system shall include relay capabilities to power the submersible turbine pumps and shut down the turbine pumps with any of the transition sumps sensors, inline transition sump sensors or dispenser sumps sensors are activated.

R. The system shall include a remote audible/visual alarm annunciator that consists of a solid state electronic wall-mounted Strobe/Siren combination housed in a NEMA 4X weatherproof enclosure. The audible annunciator shall have a minimum rating of 101db at ten (10) feet. The visual annunciator shall be Xenon strobe type with a minimum rating of fifteen (15) candelas. A test button shall be provided to verify operation of both the audible and visual alarms.

i. Remote audible/visual alarm annunciator with acknowledgement switch shall be placed within 25 feet of the remote fill for the tank(s).

S. System shall operate on 110, 50/60 Hz line voltage.

T. Acceptable Manufacturers: Veeder-Root

2.6 Fill Line Equipment:

A. AST Overfill Prevention Valve: 2” valve installed at the fill port of an aboveground storage tank. Used in a tight fill application, the valve terminates flow of product when the liquid level reaches a preset warning level.

i. Anodized aluminum body, nickel plated shaft, linkage and hardware with stainless steel piping construction.

ii. The Contractor is responsible to confirm that all products provided and installation are compatible with the product being stored

iii. Adjustable float (1½") for setting the precise level of shutoff in the field and allowing it to be done using standard length pipe nipples

iv. Immediate and cushioned shutoff…full flow up to within 1-2 seconds of closing and no abrupt kickback or jolt, or startling noise in the line when valve closes.

v. Must be compatible with the product to be stored and E-85 for future use.

vi. Quantity of (1) per tank.

vii. Acceptable Manufacturers: Morrison Brothers Co., OPW Fueling Components, Clay & Bailey or equal.

B. Drop Tube: 2” tube to direct the product flow to liquid level when filling a storage tank. Prevents free fall and reduces agitation of liquid when filling.

i. Materials of construction based upon the product to be store in the above ground storage tank.

ii. The Contractor is responsible to confirm that all products provided and installed are compatible with the product being stored.

iii. Drop tube shall be extended to within 6” of the bottom of the tank and cut at a 45 degree angle across the tube.

iv. Drop tubes attach to overfill prevention valve.

v. Must be compatible with the product to be stored and E-85 for future use.

vi. Quantity of (1) per tank.

vii. Acceptable Manufacturers: Morrison Brothers Co., OPW Fueling Components or equal.

C. Swing Check Valve: 2" threaded, valve used for single-direction flow in a horizontal pipeline and/or to isolate product in a multi-product handling system.

i. Ductile iron body construction with 150# raised-face flanged connections.

ii. The Contractor is responsible to confirm that all products provided and installed are compatible with the product being stored.

iii. Poppet and seats are metal and may allow some seepage over long periods of time.

iv. Extractable poppet for access to popper for removal and repair.

v. Must be compatible with the product to be stored.

vi. Quantity of (1) per tank.

vii. Acceptable Manufacturers: Morrison Brothers Co., OPW Fueling Components or equal.

D. Full Port Ball Valve: 2" flanged, full port ball valve used for liquid handling with manual open-close in quick quarter-turn handle operation. Valve can be operated in partial open position. Lockable with padlock.

i. Aluminum body construction, stainless steel ball, Viton seals with 150# raised-face flanged connections.

ii. The Contractor is responsible to confirm that all products provided and installed are compatible with the product being stored.

iii. Must be compatible with the product to be stored.

iv. Quantity of (1) per tank.

v. Acceptable Manufacturers: Morrison Brothers Co., OPW Fueling Components or Sharpe Valve Co.

E. Quick Coupler: 2" quick detachable coupler adaptor for easy coupling of delivery transport hose to fill lines.

i. Aluminum body construction.

ii. The Contractor is responsible to confirm that all products provided and installed are compatible with the product being stored.

iii. Must be compatible with the product to be stored.

iv. Quantity of (1) per tank.

v. Acceptable Manufacturers: Morrison Brothers Co., OPW Fueling Components or Civacon.

F. Coupler Cap: 2" detachable coupler dust cap for use with the quick coupler adaptor on the fill lines.

i. Aluminum body construction.

ii. The Contractor is responsible to confirm that all products provided and installed are compatible with the product being stored.

iii. The cap shall provide means of connection to the fill line so the when not it use that the cap remains "chained" to the line.

iv. The cap shall lock to prevent unauthorized removal.

v. Must be compatible with the product to be stored.

vi. Quantity of (1) per tank.

vii. Acceptable Manufacturers: Morrison Brothers Co., OPW Fueling Components or Civacon.

G. Remote Spill Container: A 20 gallon capacity spill container shall be provided for use on aboveground storage tanks for the purpose of containing fuel spillage during remote tank filling operations.

i. 12 gauge steel construction.

ii. Lockable lid

iii. Exterior to be sand blasted, primer coated with epoxy primer and finished coated with urethane paint.

iv. 1" NPT drain with locking ball valve & steel pipe plug.

v. Spill container shall stand at approximately 30” for pipe entry for ease of use by the delivery transport drivers.

vi. Quantity of (1).

vii. Spill container shall be able to receive (2) fill lines into the unit.

viii. The hose connection shall be 2, 3 or 4” diameter as shown on the drawings. The piping shall include a camlock type hose adapter, adapter cap, manual shutoff valve, and check valve.

ix. Controls: Provide an electronic tank level controller consisting of a tank level sensor, inlet actuated valve, and control module. The module shall be microprocessor based and shall monitor tank levels during the fill operation. The panel shall respond to tank fill levels as follows: green light (normal operation at 85% or less), yellow light (active at 85%), red light and audible alarm (active at 90%), and flashing red light / audible alarm (active at 90%)

x. Control Valve: Provide an actuated butterfly valve for the fill pipe high level shutoff. The valve shall be a lug style iron body butterfly valve with stainless steel trim and viton soft goods. The valve actuator shall be NEMA 4 enclosure with limit switches, position indicator and manual override.

1. Overfill Prevention Valve: Where indicated on the drawing provide an in-tank overfill prevention valve for the tank fill connection to close automatically at the tank 90% fill level.
2. Hand Pump: Where indicated on the drawing the spill container shall include a hand pump transfer of spilled fuel to the tank fill pipe.
3. Indicator for Tank % Fill: Where indicated on the drawing the fill station control panel shall include a readout of the tank % fill.
4. Multi-Tank Fill Selection: Where indicated on the drawing the control panel shall include capability to select one of the multiple tanks for filling. High level fuel conditions in any tank shall disable the fill function for that tank but shall allow for filling of other tanks.

xi. Acceptable Manufacturers: Earthsafe, or equal.

2.7 Design Conditions

A. Loading Conditions – Tanks shall be designed to meet the following design criteria:

1. Internal load: Primary and secondary tanks shall withstand required air pressure test and required safety factors.

2. Tanks shall be designed to support accessory equipment such as, ladder, drop tubes, etc. when installed according to manufacturer's recommendations and limitations.

B. Product Storage Requirements:

1. All primary tanks must be vented. Tanks are designed for operation at atmospheric pressure only, except for use with vapor recovery systems at a pressure or vacuum of approximately 1psi.

2. Tanks shall be capable of storing liquid with specific gravity up to 1.1.

3. Maximum temperature: Tank shall be capable of storing gasoline, alcohol blended gasoline (with up to 100% methanol or ethanol), oxygenated fuels (up to 20% MTBE), av-gas, jet fuel, motor oil, (new or used), kerosene, diesel fuel or potable water at ambient underground temperatures not to exceed 150° F at the tank interior surface.

4. Tanks shall be chemically inert to petroleum products.

C. Dimensional Requirements

1. Nominal capacity of the new AST shall be 2,000 gallons for gasoline.

2. The fuel system contractor may propose an alternative tank configuration to provide the same capacity as specified above if an alternative configuration would be advantageous to the Owner.

D. Monitoring Capabilities:

1. Tanks shall have a space between the primary and secondary shell walls to allow for the free flow and containment of all leaked product from the primary tank.

2. The continuous monitoring conditions shall be compatible with the cavity between the inner and outer tanks.

3. The tank monitor shall be capable of detecting a breach in the inner and/or outer tank under the following installed conditions:

a. When the inner tank is empty.

b. When the inner tank is partially or completely full.

4. All monitoring equipment, including FRP reservoirs and electronic controls, shall be UL listed or accepted.

5. The tank monitoring system readout shall be located in the Marina Administration building office and compatible with ODNR systems.

2.3 ACCESSORIES

A. Certification Plate – Underwriters Laboratories label shall be permanently affixed to each tank.

B. Flanged Manways

1. The standard manway is 22” ID.
2. All manways will be furnished complete with U.L. listed gaskets, bolts and covers.
3. Coordinate with Fuel Storage Tank Float

C. Fill Tubes – Fill tubes of appropriate design will be supplied by contractor.

D. Fill Assembly - 12-inch diameter by 14-inch deep spill container with cast aluminum cover, pop-up handle, cast iron body ring, cover seal, container seal, replaceable polyethylene container riser seal and integral drain valve.

E. Turbine Enclosures and Collars:

1. Watertight Turbine Enclosure Model WTE Series – The watertight turbine enclosure consists of a fiberglass reinforced plastic (FRP) enclosure body (variable length in 12’ increments, 42” or 48” ID’s), an FRP reduces (42”x30” or 48”x30” ID’s) with o-ring groove and o-ring gasket, and a push-on FRP lid with two handles. The reducer opening must be large enough (minimum 28”) to allow for the removal of a 22” manway lid. The lid OD must be small enough to be removed through a 36” street box. The enclosure body must be capable of joining to the enclosure body with an external leak-tight adhesive joint to allow for field installation of the adhesive without entering the enclosure.

   With the lid installed, the assembly must provide a watertight seal with water up to 12” over the lid. The lid includes a non-skid exterior surface and must be able to support an H-20 axle load without damage to the lid. One of the lid handles is to be offset to aid in the removal of the lid and the other is centered on the lid.

F. Secondary Containment Collars and Accessories

1. Secondary Containment Collar – The secondary containment collar shall be constructed of fiberglass reinforced plastic. Collar shall be 42” or 48” in diameter and will be factory-installed in accordance with drawings.
2. Containment Collar Sensor is preassembled and ready to wire. All electrical components must be UL listed or accepted. This float switch is capable of detecting a 2” or more accumulation of liquid (water or product) in the turbine enclosure.

G. Miscellaneous Accessories

1. Ladders - Ladders shall be the standard ladder supplied by the tank manufacturer.
2. Tank Lifting Lugs – Provide lifting lug(s) on all tanks. Lifting lug system shall be capable of withstanding weight of tank with a safety factor of 2:1.
3. Probe Drawstring – Nylon line shall be 150 lb. Break strength located at the monitoring fitting nearest the end of the tank. When a reservoir is located at the position, the drawstring shall be installed within the reservoir. Drawstring length will allow for a 7’ tank burial depth.
4. Fittings Threaded – NPT
   a. All threaded fittings on UL labeled tanks shall be located in a manway lid or a tank mount within 12” of the tank top center line and be constructed consistent with the requirements of the UL label. Fittings to be supplied with threaded cast iron plugs.

b. All standard treaded fittings to the primary tank and monitoring cavity are 4” in diameter. The standard secondary containment coupling is 6” in diameter. All standard threaded fittings are half couplings. Reducers are to be used for smaller sizes where specified and provided by contractor.

c. Thread Standards – All threaded fittings shall have machine tolerances in accordance with the ANSI standard for each size.

d. Strength – Primary tank NPT fittings will withstand a minimum of 150 foot-pounds of torque and 1000 foot-pounds of bending, both with 2:1 factor of safety.

e. Suction Line – Shall be installed on the site by the contractor. Diameter of pipe and grade and schedule as called out in other sections.

f. Return Line – Shall be installed on the site by the contractor. Diameter of pipe and grade and schedule as called out in other sections.

g. All rigid internal piping shall be terminated at least 4” from the bottom of the tank.

PART THREE EXECUTION

3.1 INSTALLATION AND TESTING

A. Tanks shall be tested and installed according to the current installation instruction provided with the tank.

B. Locate, identify, and protect utilities that remain and protect from damage.

C. Clean interior and exterior prior to painting. Remove mill scale, dirt, rust, oil, welding debris, loose coatings and coatings incompatible with fuel stored or protective coatings. Exterior cleaning to be by means of sandblasting to a commercial grit blast (SSPC-6)

b. Provide coating of rust resistant epoxy primer on non-fuel side of steel tanks. Additionally, provide two coats of fuel resistant polyurethane finish coating on all exposed surfaces and fittings of the external tank. Primer and paint mil thicknesses to be per STI – FIREGUARD® specifications.

c. Exterior color to be white.

d. Must be compatible with the product to be stored.

e. Each tank shall include:

i. All-welded steel interior and exterior tank.

ii. Horizontal, double containment, atmospheric tank for above ground installation.

iii. Entire unit factory-fabricated including steel supports.

iv. Provide tank supports which can be anchored to a floating dock.

v. All necessary threaded bungs welded along the top of the vessel for equipment to be

installed in each tank.

vi. Flanged bungs welded along the top of the vessel for the primary and secondary emergency vents must be used.

vii. Factory installed lifting lugs integrally manufactured onto the tank by the manufacturer (Minimum of 2)

viii. Tank support b-skids shall be welded to the tanks with a wear plate between the tank and the tank skid consisting of a minimum, ¼" carbon steel plate. (Minimum of 2)

ix. Coordinate tank support locations with engineer for floating barge

3.2 WARRANTIES

A. Accessory Warranty – All accessories are warranted to be free from material defects in workmanship and materials for a period of one (1) year following date of original delivery.

END OF SECTION

SECTION 15094
HANGERS, SUPPORTS & ESCUTCHEONS (DOCKAGE AND GANGWAYS)

PART ONE – GENERAL

1.01 DESCRIPTION

A. All piping shall be adequately supported.

B. Pipe movement shall be controlled to avoid strain on pipe fittings and connections.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Plumbing for Dockage: Section 22 11 00.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, recommendations, and installation instructions for each type of hanger or support to be used.

1.04 APPLICABLE PUBLICATIONS

A. All supports and hangers shall conform to the latest requirements of the American National Standard Institute (ANSI) Code for pressure piping B31.1.0 and Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry Inc. SP-58 and SP-69 except as supplemented or modified by the requirements of this specification.

PART TWO – PRODUCTS

2.01 HANGER TYPES

A. Hangers shall encircle pipe and pipe insulation. Strap hangers are not acceptable. Elcen Clevis type Figure 12, 12C, and 89, Grinnell Figure 260, F & S Figure 86.

B. For horizontal pipes supported from walls, support pipes with "J" hooks. Elcen Figure 45 and 46, Grinnell, F & S Figure 1788.

C. For vertical pipes supported from walls, support pipes with "U" clamps. Elcen Figure 43 and 46, Grinnell Figure 137, F & S Figure 137.

2.02 ACCESSORIES

A. Hanger material in contact with the pipe must be same material as pipe, or coated with same material as pipe, or provided with Cush-A-Strip di-electric isolator.

B. For insulated pipe provide galvanized sheet metal saddle with flared edges on all four sides to protect pipe insulation.

C. Minimum hanger rod shall be per manufactures recommendation, and shall be vertically adjustable.

PART THREE – EXECUTION

3.01 INSTALLATION

A. Hangers and supports shall secure pipes in position to maintain specified pitch and allow for expansion and contraction.

B. Maximum hanger spacing per manufactures recommendation. Hangers shall also be located within 2'-0" of corners.

C. Hang plastic piping using no more than maximum hanger spacing as recommended by manufacturer.

D. Install non-compressing insulation spacer between pipe and hanger.

E. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve.

F. Adjust hangers and supports to place piping at proper pitch and elevations.

END OF SECTION

SECTION 15400
PLUMBING FOR MARINA DOCKAGE

PART ONE - GENERAL

1.01 SUMMARY

A. Section Includes: The water distribution system on floating dockage systems and gangways starting at the land based connection (backflow preventer).

1.02 REFERENCES

A. ASTM F441 – Standard Specification for Chlorinated Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40 and 80.

B. ASTM A795 – Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

1.03 SYSTEM DESCRIPTION

A. The complete water distribution system shall be designed for the distribution of potable water to individual Dock Utility Centers or fire protection water to individual dry standpipes in accordance with State of Ohio and Local Codes and standards.

1.04 SUBMITTALS

A. Contractor shall submit applications, pay all fees and secure all required permits and approvals. The responsibility for proper installation of the systems rests with the Contractor. If additional fees are incurred for repeat reviews due to improper initial design, those costs will be borne by the Contractor.

B. Submit with the Dock Operations Manual a detailed description of operations and winter shutoff procedures.

C. The Contractor shall perform a flow and pressure test of the completed system to be witnessed by the ODNR Project Manager and appropriate other authorities.

D. All work in this section shall be considered and included under the dockage system Guarantee in Section 02488 Floating Docks and Gangway

PART TWO - PRODUCTS

2.01 MATERIALS

A. All materials used in construction of the plumbing system shall comply with State of Ohio Codes and standards where applicable for the intended use.

B. Unless otherwise required by plumbing codes, marina based potable water piping shall be CPVC Schedule 40 in accordance with ASTM F441. Flexible piping for connections to Dock Utility Centers from the main header pipe shall be Kuri Tec K3150 braided flexible hose, or ODNR approved equal.

C. Unless otherwise required by plumbing codes, marina based fire protection pipe shall be Schedule 10 galvanized pipe with groove lock fittings in accordance with ASTM A795. Fittings and pipe shall be pressure-rated for a minimum of 700 psi.

D. Backflow preventers shall be provided for each potable water marina service, sized appropriately for each line and include aluminum box enclosures.

E. Drain valves shall be ball valves.

F. Flexible connections to allow for ramp movement and between pier sections shall be flexible piping conforming to plumbing code requirements. Length as required to accommodate movement. Secure piping as required to restrict any lateral movement at the utility vault. Flexible stainless steel braided hoses used at the gangways shall have cam lock ends to allow winter removal and storage.

G. Dry fire line Siamese connection shall meet Fire Department dimensional requirements.

H. Flexible stainless steel braided hoses used at the gangways shall have cam lock ends to allow winter removal and storage

PART THREE - EXECUTION

3.01 PIPING SYSTEM INSTALLATION

A. Provide complete water system service on the docks to serve the locations shown on the drawings.

B. Provide all flexible connections required to allow for vertical and lateral movement of the pier relative to shore and for differential movement of the floating pier sections.

C. Design shall accommodate expansion of dockage water main. Consider ambient temperature in relation to service range during installation of the flexible joints.

D. Provide 3/4 inch valve at the end of the header pier in a location to provide system drainage. Provide an access point on the dock to reach the drain valve from the surface of the dock. A drain valve must be located so that when an air pressure is applied at the shore side 3/4 inch blowoff valve; all water may be ejected from the system.

E. Piping system shall be tested in compliance with local code. All water mains shall be disinfected in compliance with City standards.

F. All utility connections should be designed for disconnection without entering the water and with a minimum of effort.

END OF SECTION

SECTION 15410
SANITARY PUMP OUT FOR MARINA DOCKAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Sanitary pump-out unit, and discharge piping installed on to the marina building. Pump-out system includes, but is not necessarily limited to, remote pedestals, suction hoses, appurtenances, wiring, controls, product piping, and wiring.

1.02 REFERENCES

A. ASTM International, as referenced herein as ASTM.

1.03 SUBMITTALS

A. Product Data:

1. Product data for approval to the Engineer prior to delivery on-site.

2. Product data for sanitary pump-out unit, discharge piping and piping expansion joint.

B. Source Quality Control:

1. Submit manufacturer's operation and maintenance manual prior to application for final payment.

C. Field Quality Control:

1. Submit record documents prior to application for final payment for the complete, operational system.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

B. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

C. Provide equipment and personnel to store products by methods to prevent disfigurement or damage.

D. Acceptance of products on site by Contractor is verification by him that all products are operable and free from defects.

1.05 WARRANTY

A. Provide one year warranty from defective workmanship and materials. A copy of the manufacturer's warranty shall be submitted to the Owner prior to application for final payment of the complete system.

PRODUCTS

2.01 MANUFACTURERS

A. Specifications are based upon Keco 900 Series, Model 900R-A40 system, suction hoses and remote stands, and a totally compatible system is required upon completion.

B. Expansion joint specifications are based upon Plastic Piping Systems, Inc., and a totally compatible system is required upon completion.

2.02 MATERIALS

A. All materials used in construction of the sanitary pump-out system shall comply with the Ohio Building Code where applicable for the intended use and all other applicable local codes and requirements.

B. The sanitary pump-out system shall be manufactured of non-corrosive materials or baked epoxy coated. Stainless steel parts including nuts and bolts shall be 300 grade. The vacuum sanitary pump-out system shall include the following components:

1. The unit shall be designed for viscous material handling, sanitary waste, bilge, and bilge and solids. System shall be peristaltic unit with leak detection system and automatic timers.

2. The pumps shall have an individual capacity of 35 GPM shall be capable of passing a 1-1/2 inch solid.

4. Sanitary station suction hose shall be heavy duty, 1-1/2 inch inner diameter, chemical and oil resistant, crush-resistant, corrosion-resistant, ultraviolet-resistant and lightweight. The operating range of the hose shall be -20 degrees F to 120 degrees F. The hose interior shall be smooth to avoid trapping solids and all joints shall be reinforced. A shut-off valve shall be provided integral with each hose to provide them with air-tight, drip-tight shut-off when not in use. Suction end of hose shall have a neoprene adaptor for marina sanitation connections. Connector shall be complete with brass or other suitable reinforcement. Hose shall be 40 feet in length and be capable of passing a 1-1/4 inch solid. Hose shall be clear or provide a sight glass to verify completion of pump-out process.

5. Sanitary pump-out stations shall be provided with suitable hose stands to allow complete coiling of the suction hose length on the stand. Stands shall be as shown on the drawings.

6. Sanitary pump-out system shall be provided with and controlled by switches and controls which will perform the following functions:

a) Automatically control the unit and timers for the unit.

b) A timer to automatically shut-off the machine at a preset amount of time.

7. Sanitary discharge line expansion joints shall be a 2 inch PPS piston expansion joint Model 0291323 as manufactured by Plastic Piping Systems, Inc., New Jersey, (201) 981-1800, or approved equivalent substitution.

8. Sanitary product pipe shall be 2 inch PVC pipe SDR 35 conforming to ASTM D2241 with threaded connections and fittings.

2.03 OTHER MATERIALS

A. All other materials, not specifically mentioned, but required for a satisfactory installation shall be first-class of their respective kinds, as selected by the Contractor and subject to the approval of the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate piping, wiring, plumbing, and pump-out unit installation with the other trades.

3.02 INSTALLATION

A. Sanitary pump-out system shall be installed in accordance with manufacturer's recommendations including, but not necessarily limited to, the following:

1. Engineer to review installation method of hose stations prior to installation.
2. Install pipe and fitting in accordance with ANSI/ASTM D2241.
3. Provide full pipe support for all piping, not to exceed 10 foot intervals.
4. All joints shall be tight and true.
5. Installation of expansion joints shall consider ambient temperature in relation to service during installation.

END OF SECTION

SECTION 15450

FUEL DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fuel dispensers, tank accessories, piping, valves, and specialties for fuel distribution. Contractor shall, as part of this contract, provide (furnish and install) a complete fueling system for gas dispensing on the new floating dock. The Contractor is responsible for providing a complete fuel system that meets all regulatory and permitting requirements. This includes (but not limited to) signage at tank dispensers, emergency shutoffs, Point of Sale system, credit card payment system, remote fuel fill station and controls, and supervisory/control equipment.

B. Related Sections include the following:

1. Section 02488 Floating Dockage
2. Section 13220 Aboveground Fuel Storage Tank
3. Applicable Division 16 Sections for work related to power and control wiring.

1.2 REFERENCES

A. NFPA 30 Flammable and Combustible Liquids Code

B. NFPA 30A Motor Fuel Dispensing Facilities and Repair Garages

C. NFPA 303 Fire Protection Standard for Marinas and Boat Yards

D. NEC Article 555 Marinas and Boat Yards

E. PEI/RP 1000-09: Recommended Practices for the Installation of Marina Fueling Systems

F. UL 971 Standard for Nonmetallic Underground Piping For Flammable Liquids

1.3 DEFINITIONS

A. AST: Aboveground, fuel storage tank(s).

B. Fuel: Gasoline

C. PE: Polyethylene plastic.

D. PTFE: Polytetrafluoroethylene plastic.

E. RTRP: Reinforced thermosetting-resin pipe.

F. TFE: Tetrafluoroethylene plastic.

G. POS: Point of Sale System

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Contractor shall provide (furnish and install) equipment for a complete marina fuel station.

B. Provide tank and line monitoring system to provide inventory and leak detection information for tanks and piping compatible with ODNR systems (Veeder Root)

C. System shall include two dock mounted dual fuel dispensers with retractable hose reels and 50 feet of hose per nozzle.

D. Provide Remote Fuel Fill and alarm system.

E. Provide Credit Card and Point of Sale System in the Fuel Attendant building.

1.5 SUBMITTALS

A. Product Data: Include identification of materials and devices; and sizes, dimensions, capacities, pressure ratings, and operating characteristics for the following:

1. AST details.
2. Submersible fuel pumps.
3. Fuel storage tank, accessories and specialty fittings.
4. General- and special-duty valves.
5. Double-contained piping systems and associated sumps.
6. Liquid-level gage systems.
7. Point of Sale System (POS)
8. Fuel dispensers.

B. Shop Drawings: Include storage tanks, accessories, pipe sizes, valves, and specialties. Include details of underground piping.

1. Wiring Diagrams: For each item of equipment with electric power supply. Include ladder-type wiring diagrams for interlock and control wiring required for final installation. Differentiate between factory-installed and field-installed wiring.
2. Layout Drawings: Submit arrangement and location drawings for the fuel system, identifying components and dimensions.

C. Permits: Contractor shall obtain required permitting from state and local regulatory bodies.

D. Test Reports: As specified in "Field Quality Control" Article.

E. Maintenance Data: For accessories and specialties to include in maintenance manuals specified in Division 1.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of fuel distribution components and are based on specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered.

B. Distribution Components: Listing/approval stamp, label, or other marking by testing agency acceptable to authorities having jurisdiction.

C. Electrical Devices, Components, and Equipment: Listed and labeled according to NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Explosion proof fittings to be installed where required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare storage tanks, accessories, valves, and specialties for shipping as follows:

1. Ensure that units are dry and internally protected against rust and corrosion.

2. Protect against damage to threaded ends, flange faces, and weld ends.

3. Set valves and specialties in position for handling that avoids damage to seats and operating parts.

B. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent damage and entrance of dirt, debris, and moisture.

C. Store valves and specialties with end protectors in place, unless necessary for inspection; then reinstall for storage.

D. Store valves and specialties indoors and maintain temperature higher than ambient dew-point temperature. Support off ground or pavement in watertight enclosures if outdoor storage is necessary.

E. Protect stored piping from moisture and dirt. Elevate above grade.

F. Protect flanges, fittings, and piping specialties from moisture and dirt.

G. Store plastic pipes protected from direct sunlight. Support pipes to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Contact utility-locating service and verify existing utility locations prior to any excavation.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner’s written permission.

1.9 COORDINATION

A. Coordinate POS, AST, Remote Fuel Fill, Monitoring System, and floating fuel barge.

1.10 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by fuel storage tank manufacturer agreeing to repair or replace tanks that fail in materials or workmanship within specified warranty period, provided tanks are installed according to manufacturer's written instructions. Failures include structural failures of tanks, including cracking, breakup, and collapse; and failure due to external and internal corrosion if used for storage of fuels at temperatures not exceeding 150 deg F (66 deg C).

C. Warranty Period: Tank and structural accessories; 30 years from date of Substantial Completion. Electronic components; 1 year parts and labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All equipment proposed shall meet the applicable standards and regulations for the State of Ohio. Manufacturers shall be identified in the plan submittal and documentation of their acceptability and suitability shall be submitted for review and acceptance prior to the release for installation.

2.2 PIPING MATERIALS

A. Flexible, Double-Contained Pipe: nonmetallic, multilayered, flexible, plastic, primary pipe with braided fabric reinforcement and flexible, plastic, secondary pipe for use in underground applications only. Include manufacturer's standard bulkhead and termination assemblies.

B. Flexible, Double-Contained, Metallic Ducted Pipe: metallic ducted, multi-layered, flexible, plastic, primary pipe with braided fabric reinforcement and flexible, plastic secondary pipe for use in aboveground applications only. Include manufacturers standard bulkhead and termination assemblies (APT or Engineer approved equal).

C. All connections between lengths of pipe shall be contained within an appropriate sump container.

2.3 SUBMERSIBLE FUEL PUMPS

A. Description: UL 79, turbine type, capable of delivering 15 gpm at each pump.

B. Power Supply: Per fuel system supplier.

C. Provide four (4) hose reels for the two dual fuel dispensers. Equal to Duro model 3012 manual hose reel, 3/4” x 50’ hose.

2.4 NOZZLES

A. Provide nozzles for each fuel hose reel with automatic shut-off type for fuel, aluminum body with 1” inlet, UL listed, and dual poppets. Provide colored hand insulators.

2.5 DISPENSING STATION

A. Provide a dual gasoline fuel dispensing station in the location, arrangement and type as shown on the Drawings, with the following provisions:

1. Arranged for power supply, UL-labeled and explosion-proof.

2. Fuel System Dispensers shall have powder coated or stainless steel frames.

3. Enclosure shall be weatherproof stainless steel.

4. Mechanical or electronic dispensers are acceptable

5. Non-computer, mechanical type register with power reset interlock, indicating gallons and tenths in a four-digit readout with display both front and back of cabinet.

6. Non-reset type totalizer readable from the front without opening the cabinet.

7. Gear type pump with air eliminator built into the pump casing and rated for 15gpm.

8. Three-piston, positive displacement meter, tested and calibrated for accuracy at any speed or pressure.

9. Stainless steel cabinet finish, weatherproof for an outdoor installation.

10. Provide a credit card payment center and POS in the fuel attendant building.
Point of Sale (POS) System: The purpose and intent of the POS System is to:

a. Single Control point for fuel sales supporting both preset and prepay fuel sales.

b. Electronically tracks up to 32 fueling positions on an icon display screen.

c. The system shall work with all Major oil networks.

d. The system shall interface with a wide range of petroleum card networks, including those that communicate with independent oil companies.

e. The system shall use fuel icons for fast visual and audible verification of pump status.

f. The system shall stack fuel sales to free a pump for immediate use.

g. The system shall use programmable PLU keys to help simplify sales procedures and expedite service.

h. The system shall allow remote data access for fast, real-time downloads.

i. The system shall allow all store administration to be done from either the back office or remote location without interrupting in-store sales.

j. The system shall allow transaction logging on all data including in-store sales, fuel sales, DCR sales and system journaling by site, register, and cashier.

k. The system shall allow for changing fuel pricing and inventory, edit receipt printers or footers, enhance card-reader displays, set up POP fuel discounting, and add Mix and Match deals directly from your desktop.

l. System Components:

i. POS system shall include:

i. Ruby Console RU II 120 Key
ii. Cash Drawer
iii. Cash drawer adapter kit
iv. Customer display 2-line
v. Sapphire
vi. V950
vii. Cisco ASA Router
viii. Wayne Fuel communication kit
ix. Thermal Receipt printer, RP-310
x. Adapter, Null Modem, DB25-RJ45
xi. Cable, RS232, 10FT
xii. HPV-20 Workstation card
xiii. Site fully loaded Bravo card
xiv. Cable, Ethernet 30.5
xv. Cable, Ethernet 75.2M
xvi. 25ft LAN cable
xvii. Adapter, DB25M – VSAT
xviii. Cable, 100’ Shielded RS232
xix. 9 pin Female null modem
xx. MX850 base pinpad
xxi. Cable, MX8XX VFI POS USB
xxii. Cable RS232 10’
xxiii. Pinpad stand
xxiv. Sapphire software license
xxv. Sapphire/HPV-20 PSP Help desk, 1st year
xxvi. Ruby Supersystem PSP Help desk, 1st year
xxvii. Sapphire/HPV-20 PSP ASM 1st year
xxviii. MX Series pinpad ASM, 1st year
xxix. Sapphire Management suite
xxx. Oneac UPS units
xxxi. Receipt paper

ii. The unit shall be 110/240 VAC, 50/60Hz
iii. The system shall have warranty of 12 months covering both parts and labor.

m. Acceptable Manufacturers: Verifone or equal.

2.6 SOURCE QUALITY CONTROL

A. Perform factory tests, according to all applicable UL and STI standards, after fabrication and before shipment.

PART 3 - EXECUTION

3.1 EARTHWORK

G. Excavation, trenching, and backfilling shall be in accordance with the Specifications and fueling systems manufacturer's backfill requirements.

3.2 PIPING APPLICATIONS

A. Use flanges, unions, transition and special fittings, and valves with pressure ratings same or higher than system's pressure rating in aboveground and containment sump applications, unless otherwise indicated.

B. Aboveground, Fuel Piping: 2-Inch NPS and Smaller: Flexible, double contained metallic ducted pipe with manufacturer's fittings.

C. Aboveground Vent Piping: 2-Inch NPS and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints. Vent piping shall be painted black.

D. Underground, Fuel Piping: Flexible, double-contained pipe and fittings for flexible pipe or Steel pipe/RTRP double-contained piping.

E. Underground, Gage and Vent Piping:

1. RTRP and RTRP fittings, and bonded joints. Use 2-inch NPS RTRP and RTRP fittings, if smaller sizes are not available.

2. 2-inch NPS flexible pipe and fittings for flexible pipe may be used for vent piping.

3.3 PIPING INSTALLATION

A. Install all piping in accordance with State, local and National Codes.

B. Install piping free of sags and bends.

C. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

D. Install fittings for changes in direction and branch connections.

E. Install rigid, underground, double-contained, fill and vent piping at a minimum uniform slope of 0.2 percent downward toward sump.

F. Install flexible, double-contained, fuel pipe sloped per plan.

G. Install flexible, vent pipe at a minimum slope of 2 percent downward toward fuel storage tank sump.

H. Install double-contained piping according to manufacturer's written instructions for assembly, joining, trench preparation, and installation.

I. Install and terminate double-contained piping at fuel storage tank containment sumps and within manufacturer’s standard piping sumps.

3.4 CONNECTIONS

A. Connect vent, fill, sounding, gage, and other piping to fittings and specialty devices.

B. Piping Connections: Make piping connections as follows, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.

2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

3. Install dielectric unions to connect piping of dissimilar metals.

C. Make connections to liquid-level gage system.

D. Make connections to fuel storage tank leak-detection system.

E. Make electrical connections to pumps, control panels, liquid-level gages, and leak-detection and -monitoring devices.

F. Electrical wiring, disconnect switches, and motor controls are specified in Division 16.

3.5 LIQUID-LEVEL GAGE SYSTEM INSTALLATION

A. Install liquid-level gage systems according to manufacturer's written instructions. Monitoring equipment shall be installed in the Marina Services Building. The marina services building will be constructed concurrently with marina. Fuel contractor shall coordinate with building contractor for installation of fuel monitoring equipment at the appropriate point in the building construction schedule.

3.6 LEAK-DETECTION AND -MONITORING SYSTEM INSTALLATION

A. Install leak-detection and -monitoring systems according to manufacturer's written instructions. Alarm panel inside building installed as part of Amenities Building.

1. Fuel Storage Tanks: Use factory-installed, integral probes in interstitial space of double-wall tanks.

2. Fuel Double-Contained Piping: Install leak-detection sensor probes in fuel storage tank containment sumps.

3. Install liquid-level gage systems according to manufacturer's written instructions.

3.7 LABELING AND IDENTIFYING

A. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes during backfilling of trenches for piping. Locate tapes 6 to 8 inches (150 to 200 mm) below finished grade and directly over piping and edges of each fuel storage tank.

1. Warning tape shall be polyethylene film type manufactured for the purpose of marking and identifying underground utilities, 6 inches wide by 4 mils thick, continuously inscribed with description of utility, with metal core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30” deep; yellow in color.

3.8 FUEL DISPENSER INSTALLATION

A. Install dispensers with containment sumps below. Install emergency shut-off valves at connections to fuel piping.

3.9 FIELD QUALITY CONTROL

A. Perform pressure test for tightness, with air, inert gas, or water according to NFPA 30 and NFPA 31 on tanks before installation. Apply soap solution to joints and check for leaks.

B. Repair or replace defective tanks and retest until there are no leaks.

C. Test fuel distribution piping according to NFPA 30 and NFPA 31. Remake leaks and defects with new materials and retest until there are no leaks.

D. Test and adjust leak-detection and -monitoring system controls and devices. Replace damaged and malfunctioning controls and devices.

E. Report test results promptly in writing to Engineer and authorities having jurisdiction.

3.10 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative for leak-detection system to train Owner's maintenance personnel to adjust, operate, and maintain systems.

1. Train Owner's maintenance personnel on procedures and schedules for starting up and shutting down, troubleshooting, servicing, and maintaining leak-detection equipment and pumps.

2. Review data in maintenance manuals. Refer to General & Special Requirements.

3. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION

SECTION 16051
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceways and cables.
2. Sleeve seals.
3. Grout.
4. Common electrical installation requirements.

1.2 SUBMITTALS

A. Product Data: For sleeve seals.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements product by one of the following:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.

3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
4. Pressure Plates: Carbon steel. Include two for each sealing element.
5. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

J. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

K. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

END OF SECTION 16051

SECTION 16060
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches (16 by 2400 mm) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

B. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

C. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

D. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 2 Section "Underground Ducts and Utility Structures," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.

   a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

SECTION 16075
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

C. Tag: Type I:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 4 mils (0.1 mm).
3. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
4. 3-Inch (75-mm) Tensile According to ASTM D 882: 30 lbf (133.4 N), and 2500 psi (17.2 MPa).

D. Tag: Type ID:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 9 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

G. Painted Identification: Comply with requirements in Division 9 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 10-foot (3-m) maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service andbranch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 16075

SECTION 16120
CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

C. Multiconductor Cable: Comply with NEMA WC 70 for nonmetallic-sheathed cable, Type NM and with ground wire.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.4 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coatingof length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Nonmetallic-sheathed cable, Type NM.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

F. Class 1 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

H. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting flush with both wall surfaces.

E. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

F. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

H. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

I. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7 Section "Through-Penetration Firestop Systems."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 16120

SECTION 16124
MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes cables, splices, terminations, and accessories for medium-voltage electrical distribution systems.

1.2 SUBMITTALS

A. Product Data: For each type of cable, splice and termination.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2 and NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cables:

   a. American Insulated Wire Corp.; a Leviton Company.
   b. BICC Brand-Rex Company.
   c. General Cable Corporation.
   d. Kerite Co. (The); Hubbell Incorporated.
   e. Okonite Company (The).
   f. Pirelli Cables & Systems NA.
   g. Rome Cable Corporation.
   h. Southwire Company.

2. Cable Splicing and Terminating Products and Accessories:

a. Engineered Products Co.
b. G&W Electric Co.
c. MPHusky.
d. Raychem Corp.; Telephone Energy and Industrial Division.
e. RTE Components; Cooper Power Systems, Inc.
f. Scott Fetzer Co. (The); Adalet, Inc.
g. Thomas & Betts Corporation.
h. Thomas & Betts/Elastimold.
i. 3M Company; Electrical Products Division.

2.2 CABLES

A. Cable Type: MV105, with copper conductor and concentric lay, class B stranding.

B. Comply with UL-1072, AEIC CS8, ICEA S-93-639, and ICEA S-97-682.

C. Strand Filling: Conductor interstices are filled with impermeable compound.

D. Conductor Insulation: Crosslinked polyethylene.

E. Conductor Insulation: Ethylene-propylene rubber.

1. Voltage Rating: 35 kV.
2. Insulation Thickness: 133 percent insulation level.

F. Shielding: Solid copper wires, helically applied over semiconducting insulation shield.

G. Shielding and Jacket: Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.

H. Cable Jacket: Chlorosulfonated polyethylene, CPE.

2.3 SPLICE KITS

A. Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application.

1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
2. Heat-shrink splicing kit, polymeric construction with outer heat-shrink jacket.
3. Premolded, cold-shrink-rubber, in-line splicing kit.
4. Premolded EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.

2.4 SOLID TERMINATIONS

A. Multiconductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.

1. Compound-filled, cast-metal body, metal-clad cable terminator for metal-clad cable with external plastic jacket.

2. Cold-shrink sheath seal kit with preformed sleeve openings sized for cable and insulated conductors.
3. Heat-shrink sheath seal kit with phase- and ground-conductor rejacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.
4. Cast-epoxy-resin sheath seal kit with wraparound mold and packaged, two-part, epoxy-resin casting material.

B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class is equivalent to that of cable. Include shield ground strap for shielded cable terminations.

1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone rubber, insulator modules; shield ground strap; and compression-type connector.
2. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.
3. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief shield terminator; multiple-wet-process, porcelain, insulator modules; shield ground strap; and compression-type connector.
4. Class 1 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, compression-type connector, and end seal.
5. Class 2 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.
6. Class 3 Terminations: Kit with stress cone and compression-type connector.

C. Nonshielded-Cable Terminations: Kit with compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.

2.5 SEPARABLE INSULATED CONNECTORS

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.

B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

C. Load-Break Cable Terminators: Elbow-type units with 200-A load make/break and continuous-current rating. Include test point on terminator body that is capacitance coupled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

D. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."

E. Install direct-buried cables on leveled and tamped bed of 3-inch- (75-mm-) thick, clean sand. Separate cables crossing other cables or piping by a minimum of 4 inches (100 mm) of tamped earth.

1. Install permanent markers at ends of cable runs, changes in direction, and buried splices.
2. Install "buried-cable" warning tape 12 inches (305 mm) above cables.

F. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit.

G. Install cable splices at pull points and elsewhere as indicated; use standard kits.

H. Install separable insulated-connector components as follows:

1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
2. Portable Feed-Through Accessory: Three.
3. Standoff Insulator: Three.

I. Seal around cables passing through fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."

J. Ground shields and metal bodies of shielded cable at terminations, splices, and separable insulated connectors.

K. Identify cables according to Division 16 Section "Electrical Identification."

3.2 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters.

END OF SECTION 16124

SECTION 16138
UNDERFLOOR RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Flat-top, single-channel, underfloor raceways.
2. Flat-top, multichannel, underfloor raceways.
3. Cellular metal underfloor raceways.
4. Trench-type underfloor raceways.
5. Service fittings

1.2 SUBMITTALS

A. Product Data: For underfloor raceway components, fittings, and accessories.

B. Shop Drawings: For underfloor raceways. Include floor plans, assembly drawings, sections, and details.

1. Identify components and accessories such as expansion-joint assemblies, straight raceway lengths, preset and afterset inserts, and service fittings.
2. Provide dimensions locating raceway header and distribution elements. Include spacing between preset inserts and between preset inserts and ends of duct runs, walls, columns, junction boxes, and header duct connections.
3. Show connections between raceway elements and relationships between components and adjacent structural and architectural elements including slab reinforcement, floor finish work, permanent partitions.
4. Indicate height of preset inserts, junction boxes, and raceways coordinated with depth of concrete slab and floor fill.
5. Indicate thickening of slabs where required for adequate encasement of raceway components.
6. Document coordination of exposed components with floor-covering materials to ensure that fittings and trim are suitable for indicated floor-covering material.
7. Revise locations from those indicated in the Contract Documents, as required to suit field conditions and to ensure a functioning layout. Identify proposed deviations from the Contract Documents.
8. Show details of connections and terminations of underfloor raceways at panelboards and communication terminal equipment in equipment rooms, wire closets, and similar spaces.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain underfloor raceway components for each system through one source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FLAT-TOP, SINGLE-CHANNEL, UNDERFLOOR RACEWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Square D; Schneider Electric.
2. Thomas & Betts Corporation; Steel City Division.
3. Walker Systems, Inc.; a Wiremold company.

D. Description:

1. Material: Steel.
2. Cross-Section Shape: Rectangular.
3. Number of Levels: One.
4. Minimum Bending Radius for Communication Cables: Combination of raceways, fittings, inserts, junction boxes, service fittings, and mounting and connection arrangements for wiring devices and jacks shall provide a 2-inch- (50-mm-) minimum bending radius for communication cables.

E. Service Raceways: Fitted with preset inserts.

1. Nominal Raceway Dimensions:

a. Depth: 1-1/2 inches (38 mm).
b. Power Service Raceway Width: 3-1/2 inches (90 mm).
c. Communication Service Raceway Width: 6-1/2 inches (165 mm).

2. Number of Single-Channel Raceways per Run: Four unless otherwise indicated.
3. Preset Inserts: Round.

a. Spacing: 24 inches (600 mm) o.c.
b. Size: Rectangular dimensions as required to accommodate mounting and connection of flush-mounted, duplex receptacle or dual communication-jack or connector service fitting.

c. Size: 2 inches (50 mm) in diameter.
d. Equip each insert with a disposable cover and select insert height so cover is 1/8 inch (3 mm) below surface of concrete.
e. Arrange insert for optional attachment of flush-, surface-, or wiring- extension service fitting to replace disposable cover.

F. Header Raceways: Single channel, without preset inserts (blank raceway).

1. Nominal Raceway Dimensions:

a. Depth: 1-1/2 inches (38 mm).
b. Power Header Raceway Width: 3-1/2 inches (90 mm).
c. Communication Header Raceway Width: 3-1/2 inches (90 mm).

2. Arrangement: In same plane as service raceways.
3. Connections: Arranged to connect with service raceways at single-level junction boxes.

2.2 FLAT-TOP, MULTICHANNEL, UNDERFLOOR RACEWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Square D; Schneider Electric.
2. Thomas & Betts Corporation; Steel City Division.

D. Description:

1. Material: Steel.
2. Cross-Section Shape: Rectangular.
3. Number of Longitudinal Channels: Two, separated by steel wall(s).
4. Number of Levels: One.
5. Minimum Bending Radius for Communication Cables: Combination of raceways, fittings, inserts, junction boxes, service fittings, and mounting and connection arrangements for wiring devices and jacks shall provide a 2-inch- (50-mm-) minimum bending radius for communication cables.

E. Service Raceways: Fitted with preset inserts.

1. Nominal Raceway Dimensions:

a. Depth: 1-3/8 inches (35 mm).
b. Power Service Channel Width: 3-1/2 inches (90 mm).
c. Communication Service Channel Width: 3-1/2 inches (90 mm).

2. Preset Inserts:

a. Spacing: 24 inches (600 mm) o.c.

b. Size: Dimensions as required to accommodate mounting and connection of flush- and surface-mounted, single- and multiple-system service fittings or to connect to wiring extensions for feeding wall outlets for power
c. Equip each insert with a disposable cover arranged for installation with top 1/8 inch (3 mm) below surface of concrete.
d. Arrange inserts for optional attachment of flush-, surface-, or wiring-extension service fitting to replace disposable cover. Arrange brackets, mountings, barriers, and floor access covers to support, isolate, and provide access to surface outlet-mounting connector, jack, and receptacle devices.

F. Header Raceways: Multichannel, without preset inserts (blank raceway).

1. Nominal Raceway Dimensions:

a. Header Raceway Depth: Same as service raceways].
b. Power Header Channel Width: 3-1/2 inches (90 mm) [.
c. Communication Header Channel Width: 3-1/2 inches (90 mm).

2. Arrangement: In same plane as service raceways.
3. Connections: Arranged to connect with service raceways at single-level junction boxes.

2.3 CELLULAR METAL UNDERFLOOR RACEWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. HH Robertson; Division of CENTRIA.
2. Walker Systems, Inc.; a Wiremold company.

D. Service Raceways: Fitted with preset inserts.

1. Material: Steel.
2. Number of Longitudinal Cells: Three, separated by steel walls.
3. Nominal Dimensions of Cells:

a. Overall Depth: 1-1/4 inches (32 mm) unless otherwise indicated.
b. Cross-Sectional Area of Cells: Power cells: 5-1/2 sq. in. (35.5 sq. cm); communication system cells: 16 sq. in. (103 sq. cm).

4. Minimum Bending Radius for Communication Cables: Combination of raceways, fittings, inserts, junction boxes, service fittings, and mounting and connection arrangements for wiring devices and jacks shall provide a 2-inch- (50-mm-) minimum bending radius for communication cables.
5. Preset Inserts: Rectangular-shaped metal housing assemblies arranged to provide electrical outlet access to each cell of each raceway designated for service raceway use. Inserts shall be provided throughout the entire length of each such raceway.

a. Spacing: 30 inches (762 mm) o.c.
b. Include housing and connecting provisions for a flush or recessed, single-, double-, or triple-system service fitting.
c. Include mounting and connecting provisions for a surface, single- or multiple-system service fitting.
d. Include connecting provisions for a wiring-extension service fitting to feed wall outlets.
e. Equip each insert with a disposable cover plate arranged for installation with top 1/8 inch (3 mm) below surface of concrete. Arrange insert to receive a flush-, recessed-, or wiring-extension service fitting to replace disposable top.

E. Header Assembly: A junction box and raceway arrangement arranged to feed wires and cables to service raceways.

1. Three-compartment junction box connecting blank, multicell cellular header raceway (no inserts) with cellular service raceways.

a. Arrange junction box in the center of a 60-inch (152-cm) length of header raceway.
b. Cellular header raceway shall have same dimensions as service raceways.
c. Provide capability for service raceways to be run in both directions from intersection with header raceway.

2. Three-compartment junction box preassembled with blank, flat-top, multichannel header raceway (no inserts) and fitted to connect with cellular service raceway at right angles to header raceway.

a. Arrange junction box in the center of a 60-inch (152-cm) length of header raceway.
b. Provide capability for service raceways to be run in both directions from intersection with header raceway.

2.4 TRENCH-TYPE UNDERFLOOR RACEWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings product by one of the following:

1. HH Robertson; Division of CENTRIA.
2. Square D; Schneider Electric.
3. Thomas & Betts Corporation; Steel City Division.
4. Walker Systems, Inc.; a Wiremold company.

D. Trench: Steel, shop or factory welded and fabricated to indicated sizes. Include the following features:

1. Slab Depth Adjustment: Minimum of minus 1/8 inch (3 mm) to plus 5/8 inch (16 mm) before and during concrete placement.
2. Cover Supports: Height adjustable, with leveling screws to rigidly support cover assembly.

3. Screed Strip: Extruded aluminum along both edges at proper elevation without requiring shim material.
4. Trim Strip: Select to accommodate floor finish material.
5. Partitions: Arranged to separate channels and isolate wiring of different systems.
6. Grommeted openings in active floor cells or service raceways.
7. Manufacturer's standard corrosion-resistant finish, applied after fabrication.

E. Cover Plates: Removable, steel plates, 1/4 inch (6 mm) thick, each weighing 60 lb (27 kg) or less with full gasket attached to side units. Fabricate intermediate supports to limit unsupported spans to 15 inches (380 mm) or less. Fabricate covers with appropriate depth recess to receive indicated floor finish.

2.5 SUPPORTS, FITTINGS, AND HARDWARE

A. Supports, fittings, and hardware shall be compatible with raceway and outlet system and shall be listed for use with raceway systems and components specified.

B. Supports: Adjustable for height and arranged to maintain alignment and spacing of raceways during concrete placement. Include hold-down straps.

C. Raceway Fittings: Couplings, expansion-joint sleeves, cross-under offsets, vertical and horizontal elbows, grounding screws, adapters, end caps, and other fittings suitable for use with basic components to form a complete installation.

2.6 JUNCTION BOXES

A. Description: Manufacturer's standard enclosure for indicated type, quantity, arrangement, and configuration of raceways at each raceway junction, intersection, and access location. Include the following accessories and features:

1. Mounting brackets.
2. Escutcheons and holders to accommodate surrounding floor covering.
3. Means for leveling and height adjustment more than 3/8 inch (10 mm) before and after concrete is placed.
4. Raceway Openings: For underfloor raceways and conduits arranged to accommodate raceway layout.
5. Covers shall have appropriate depth recess to receive specific floor finish material.
6. Partitions to separate wiring of different systems.

2.7 SERVICE FITTINGS

A. Exposed Parts Finish: Brushed Aluminum.

B. Flush, Single-System Service Fitting for Round Inserts: Include mounting and cover to support and provide access to single connector, jack, or receptacle device; mounted flush with floor within body of insert.

1. Connector, Jack, and Receptacle Devices: Single modular type; complying with Division 16 Sections "Wiring Devices" and "Voice and Data Communication Cabling."
2. Power Receptacle Outlet: Suitable for 20-A device.

C. Flush, Single- System Service Fitting for Rectangular Inserts: Include mounting, hinged cover, and trim to support and provide access to connector, jack, or receptacle devices mounted flush with floor within insert.

1. Connector, Jack, and Receptacle Devices: Modular type; complying with Division 16 Sections "Wiring Devices" and "Voice and Data Communication Cabling."
2. Power Receptacle Rating: 20 A, 120 V unless otherwise indicated.

D. Recess-Mounted Service Fitting: Modular fittings compatible with preset inserts and shall include covers; provisions for receptacles, jacks, and connectors; and associated device plates for indicated systems. Include hinged flush handhole covers with recessed depth to match thickness of floor finish material. Provide for internally mounted receptacle- and communication-jack and connector assemblies complying with requirements in Division 16 Sections "Wiring Devices" and "Voice and Data Communication Cabling."

1. Duplex receptacle.
2. Duplex telephone-data jacks.
3. Double duplex receptacles.
4. Duplex receptacle and duplex telephone-data jacks.
5. Double duplex telephone-data jacks, Category 6.
6. Fiber-optic cable connector.

E. Surface-Mounted Service Fitting: Modular pedestal type, with locking attachment matched to insert floor opening.

1. Power-outlet, double-faced, surface-mounted unit for duplex receptacle on both sides.
2. Power-outlet, single-faced, surface-mounted unit for duplex receptacle on one side.
3. Communication-outlet, double-faced, surface-mounted unit.

   a. Include bushed openings on both sides; 1-inch (25-mm) minimum diameter; insulated with nonconducting material.
   b. Include provisions for modular dual fiber-optic connector assembly on both sides.
   c. Include provisions for modular dual jack-connector assembly, rated for Category 6 on both sides.

4. Communication-outlet, single-faced, surface-mounted unit with bushed opening on one side; 1-inch (25-mm) minimum diameter; insulated with nonconducting material.
5. Combination surface-mounted unit for duplex receptacle on one side and with communication cable connection provision on opposite side.

   a. Communication Side: Include bushed opening; 1-inch (25-mm) minimum diameter; insulated with nonconducting material.
   b. Communication Side: Include provisions for modular dual fiber-optic connector assembly.
   c. Communication Side: Include provisions for modular dual jack-connector assembly, rated for Category 6.

F. Flush-Mounted Service Fittings: Modular fittings compatible with preset inserts and shall include covers, provisions for receptacles jacks and connector assemblies and wiring extensions to wall-mounted outlets, and associated device plates for indicated systems. Include flush handhole covers, recessed to suit floor finish material. Internally mounted, modular, receptacle, jack and connector assemblies shall comply with requirements in Division 16 Sections "Wiring Devices" and "Voice and Data Communication Cabling."

1. Duplex convenience receptacle.
2. Duplex telephone-data outlets.
3. Double duplex convenience receptacles.
4. Duplex convenience receptacle and duplex telephone-data outlets.
5. Double duplex telephone-data outlets.
6. Duplex communication jack, rated for Category 6.
7. Duplex fiber-optic communication connector.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install raceways aligned and leveled and, unless otherwise indicated, parallel or perpendicular to building walls.

B. Provide a concrete base for support of cellular metal raceway.

C. Arrange supports to attain proper elevation, alignment, and spacing of raceways. Install supports securely at ends and at intervals not to exceed 60 inches (1500 mm), to prevent movement during concrete pour.

D. Level raceway components with finished slab and make adjustments for floor finishes.

E. Remove burrs, sharp edges, dents, and mechanical defects.

F. Cap or plug boxes, insert- and service-fitting openings, and open ends of raceways.

G. Seal raceways, cells, junction boxes, and inserts to prevent water, concrete, or foreign matter from entering raceways before and during pouring slab or placing fill. Tape joints, or seal with compound, as recommended in writing by underfloor raceway manufacturer.

H. Junction Boxes: Install tops level and flush with finished floor. Install blank closure plates or plugs to close unused junction-box openings. Grout boxes in place to prevent movement during construction. Place top covers in inverted position during construction to prevent damage to surface of cover. Reinstall covers in proper position prior to final acceptance of Work.

I. Afterset Inserts: Cut, hole saw, and drill slab and raceways to allow for installation.

J. Ground underfloor raceway components.

K. Install a marker at the center of the last insert of each cell and channel of each straight run of metal underfloor service raceway to locate the insert and identify the system.

1. Install markers at last inserts on both sides of permanent walls and at first inserts adjacent to each junction box.
2. Install markers flush at screed line before pouring slab or placing fill. Extend marker with grommeted screw when floor covering is placed. Do not extend through carpet.
3. Use slotted-head screw to identify electrical power; use Phillips-head screw to identify conventional communications.
4. Use another distinctive screw head to identify third system such as special-purpose wiring.

L. Level raceway components with finished slab and make adjustments in raceway component elevation to accommodate indicated floor finishes.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual inspection of interior of each section of trench raceway to verify absence of dirt, dust, construction debris, and moisture. Replace damaged and malfunctioning components.
2. Perform point-to-point tests of ground continuity and resistance of ground path between the most remote accessible fitting on each branch of each underfloor raceway system and the main electrical distribution grounding system.

   a. Determine cause and perform correction of any point-to-point resistance value that exceeds 0.05 ohms.
   b. Comply with NETA Acceptance Testing Specifications about safety, suitability of test equipment, test instrument calibration, and test report and records.

3.3 CLEANING

A. Clean and swab out underfloor raceways, inserts, and junction boxes after finish has been applied to floor slab, and remove foreign material, dirt, and moisture. Leave interiors clean and dry.

END OF SECTION 16138

SECTION 16140
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Snap switches and wall-box dimmers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed -through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221PL for 120 V and 277 V.
b. Hubbell; HPL1221PL for 120 V and 277 V.
c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
d. Pass & Seymour; PS20AC1-PLR for 120 V.

3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

3. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.
b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass & Seymour; 1251L.

2.5 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.

4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant , die-cast aluminum with lockable cover.

2.6 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black -filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 16140

SECTION 16211
ELECTRICITY METERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes equipment for electricity metering by utility company and electricity metering by Owner.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts and wiring diagrams.

C. Field quality-control reports.

D. Operation and Maintenance Data. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Application and operating software documentation.
2. Software licenses.
3. Software service agreement.
4. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade his computer equipment if necessary.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

C. Meter Sockets: Comply with requirements of electrical-power utility company.

D. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

E. Modular Meter Center: Factory-coordinated assembly of a main service terminal box with lugs only, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   c. Siemens Energy & Automation, Inc.
   d. Square D; a brand of Schneider Electric.

3. Comply with requirements of utility company for meter center.
4. Housing: NEMA 250, Type 3R enclosure.
5. Minimum Short-Circuit Rating: 100,000 A symmetrical at rated voltage.
6. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers.
7. Main Disconnect Device: Fusible switch, series-combination rated by circuit-breaker manufacturer to protect downstream feeder and branch circuit breakers.
8. Tenant Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect circuit breakers in downstream tenant and to house loadcenters and panelboards that have 10,000-A interrupting capacity.

   a. Identification: Complying with requirements in Division 16 Section "Electrical Identification" with legend identifying tenant's address.
   b. Physical Protection: Tamper resistant, with hasp for padlock.

9. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.
10. Surge Protection: For main disconnect device, comply with requirements in Division 16 Section "Transient Voltage Suppression."

2.2 EQUIPMENT FOR ELECTRICITY METERING BY OWNER

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. E-Mon; a division of Hunt Power.
2. National Meter Industries.
3. Osaki Meter Sales, Inc.
4. Square D; a brand of Schneider Electric.

C. General Requirements for Owner's Meters:

1. Comply with UL 1244.
2. Meters used for billing shall have an accuracy of [0.2] [0.5] [1.0] percent of reading, complying with requirements in ANSI C12.20.
3. Enclosure: NEMA 250, Type 3R minimum, with hasp for padlocking or sealing.
4. Identification: Comply with requirements in Division 16 Section "Electrical Identification."
5. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
6. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.

   a. Type: Split and solid core.

7. Current-Transformer Cabinet: Listed or recommended by metering equipment manufacturer for use with sensors indicated.

D. Kilowatt-hour Meter: Electronic three -phase meters, measuring electricity used.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours and current kilowatt load. Retain accumulated kilowatt-hour in a nonvolatile memory, until reset.
3. Display: Digital electromechanical counter, indicating accumulative kilowatt-hours.

E. Kilowatt-hour/Demand Meter: Electronic three -phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours, current time and date, current demand, and historic peak demand, and time and date of historic peak demand. Retain accumulated kilowatt-hour and historic peak demand in a nonvolatile memory, until reset.

F. Data Transmission Cable: Transmit KY pulse data over Class 1 control-circuit conductors in raceway. Comply with Division 16 Section "Control-Voltage Electrical Power Cables."

G. Software: PC based, a product of meter manufacturer, suitable for calculation of utility cost allocation and billing.

1. Utility Cost Allocation: Automatically import energy-usage records to allocate energy costs for the following:
   a. At least three buildings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to NECA 400 switchboard installation requirements.

D. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."

1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
2. Equipment Identification Labels: Adhesive film labels with clear protective overlay.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
2. Turn off circuits supplied by metered feeder and secure them in off condition.
3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.

C. Electricity metering will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 16211

SECTION 16271
MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of transformers with medium-voltage primaries:

1. Liquid-filled distribution and power transformers.
2. Dry-type distribution and power transformers.
3. Pad-mounted, liquid-filled transformers.

1.2 SUBMITTALS

A. Product Data: For each type and size of transformer indicated.

B. Shop Drawings: Diagrams including power signal and control wiring.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2 and NFPA 70.

C. Comply with ANSI C57.12.28, IEEE C57.12.10, IEEE C57.12.70, and IEEE C57.12.80.

1.4 PROJECT CONDITIONS

A. Service Conditions: IEEE C37.121, usual service conditions. except for the following:

1. Wet Locations

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Electric Corporation; Power Distribution Products Division.
2. Cooper Industries; Cooper Power Systems Division.
3. Cutler-Hammer.
4. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.
5. GE Electrical Distribution & Control.
6. Hammond Manufacturing; Transformer Group.
7. Kuhlman Electric Corporation.
8. Pauwels Transformers.
9. Pioneer Transformers Ltd.
10. Siemens Energy & Automation, Inc.
11. Square D/Groupe Schneider NA.
12. Uptegraff, R. E. Mfg. Co.
13. Virginia Transformer Corp.

2.2 LIQUID-FILLED DISTRIBUTION AND POWER TRANSFORMERS

A. Description: Comply with IEEE C57.12.00 and UL 1062 for liquid-filled, 2-winding transformers.

B. Insulating Liquid: Mineral oil, ASTM D 3487, Type II; tested according to ASTM D 117.

C. Insulating Liquid: Less flammable, edible-seed-oil based, and listed by a NRTL acceptable to authority having jurisdiction as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

D. Insulating Liquid: Less flammable, dielectric, and listed by a NRTL acceptable to authority having jurisdiction as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

E. Insulating Liquid: Less flammable, silicone-based dielectric, and listed by a NRTL acceptable to authority having jurisdiction as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall have low toxicity and be nonhazardous.

F. Insulation Temperature Rise: [65/55] [55] deg C, based on an average ambient temperature of 30 deg C over 24 hours with a maximum ambient temperature of 40 deg C.

G. Basic Impulse Level: Comply with UL 1062.

H. Full-Capacity Voltage Taps: Four, 2.5 percent taps, 2 above and 2 below rated primary voltage; with externally operable, de-energized tap changer; position indicator; and padlock hasp.

I. Cooling System: Class [OA/FA, self-cooled, and with forced-air-cooled rating [.

J. Sound level may not exceed sound levels listed in NEMA TR 1, without fans operating.

K. Impedance: 5 percent.

L. Accessories:

1. Grounding pads, lifting lugs, and provisions for jacking under base.
2. Insulated, low-voltage, neutral bushing with removable ground strap.
3. Liquid-level gage.

4. Pressure-vacuum gage.
5. Liquid temperature indicator.
6. Drain and filter valves.
7. Pressure relief device.

2.3 DRY-TYPE DISTRIBUTION AND POWER TRANSFORMERS

A. Description: Comply with NEMA ST 20, IEEE C57.12.01, ANSI C57.12.50 ANSI C57.12.51 ANSI C57.12.52, UL 1562 for dry-type, 2-winding transformers.

1. Outdoor, ventilated, vacuum-pressure impregnated and with insulation system rated at 220 deg C with an 80 deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.

B. Primary Connection: Transition terminal compartment with connection pattern and bus material to match switchgear.

C. Secondary Connection: Air terminal compartment with removable cover and predrilled copper bus bars.

D. Secondary Connection: Transition terminal compartment with connection pattern to match bus duct.

E. Insulation: Rated at 220 deg C with temperature rise of 115 deg C, maximum rise above 40 deg C.

F. Basic Impulse Level: 110 kV.

G. Full-Capacity Voltage Taps: Four, 2.5 percent taps, 2 above and 2 below rated primary voltage; with externally operable de-energized, tap changer; position indicator; and padlock hasp.

H. Cooling System: Class AA/FA, self cooled, and with forced-air-cooled rating.

I. Sound level may not exceed sound levels listed in NEMA TR 1, without fans operating.

J. Impedance: 5 percent.

K. High-Temperature Alarm: Local, audible and visual alarm, and contacts for remote alarm.

2.4 PAD-MOUNTED, LIQUID-FILLED TRANSFORMERS

A. Description: Comply with ANSI C57.12.13, IEEE C57.12.00, IEEE C57.12.22 IEEE C57.12.26 for pad-mounted, 2-winding transformers. Stainless-steel tank base , cabinet, and sills.

B. Insulating Liquid: Mineral oil, ASTM D 3487, Type II, tested according to ASTM D 117.

C. Insulating Liquid: Less flammable, edible-seed-oil based, and listed by a NRTL acceptable to authority having jurisdiction as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

D. Insulating Liquid: Less flammable, dielectric, and listed by a NRTL acceptable to authority having jurisdiction as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

E. Insulating Liquid: Less flammable, silicone-based dielectric, and listed by a NRTL acceptable to authority having jurisdiction as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall have low toxicity and be nonhazardous.

F. Insulation Temperature Rise: 55 deg C when operated at rated kVA output in a 40 deg C ambient temperature.

G. Basic Impulse Level: 95 kV.

H. Full-Capacity Voltage Taps: Four, 2.5 percent taps, 2 above and 2 below rated high voltage; with externally operable, de-energized, tap changer; position indicator; and padlock hasp.

I. High-Voltage Switch: 400 A, make-and-latch rating of 10-kA RMS, symmetrical, arranged for loop feed with 4-position, gang-operated, load-break switch, oil immersed in transformer tank with hook-stick operating handle in primary compartment.

J. Primary Fuses: 150-kV fuse assembly with fuses complying with IEEE C37.47. Rating of current-limiting fuses shall be 50-kA RMS at specified system voltage.

1. Current-limiting type in dry-fuse holder wells, mechanically interlocked with liquid-immersed switch in transformer tank to prevent disconnect under load.
2. Bay-O-Net liquid-immersed fuses in series with liquid-immersed current-limiting fuses. Bay-O-Net fuses shall be externally replaceable without opening transformer tank.

K. Surge Arresters: Distribution class, one for each primary phase; complying with IEEE C62.11 and NEMA LA 1. Transformers shall have six arresters for loop-feed circuits.

L. High-Voltage Terminations and Equipment: Dead front with universal-type bushing wells for dead-front bushing-well inserts, complying with IEEE 386 and including the following:

1. Bushing-Well Inserts: One for each high-voltage bushing well.
2. Surge Arresters: Dead-front, elbow-type, metal-oxide-varistor units.
3. Parking Stands: One for each high-voltage bushing well.
4. Portable Insulated Bushings: Arranged for parking insulated, high-voltage, load-break cable terminators; one for each primary feeder conductor terminating at transformer.

M. Accessories:

1. Drain Valve: 1 inch (25 mm), with sampling device.
2. Dial-type thermometer.
3. Liquid-level gage.
4. Pressure-vacuum gage.
5. Pressure Relief Device: Self-sealing with an indicator.
6. Mounting provisions for low-voltage current transformers.
7. Busway terminal connection at low-voltage compartment.
8. Alarm contacts for gages and thermometer listed above.

2.5 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and anchor transformers on concrete bases according to manufacturer's written instructions and according to seismic codes applicable to Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit and 4 inches (100 mm) high.
2. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
3. Install dowel rods to connect concrete bases to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
4. Anchor equipment with epoxy-embedded anchor bolts that extend through concrete base and anchor into structural concrete floor.

B. Maintain minimum clearances according to manufacturer's written instructions and NFPA 70.

3.2 IDENTIFICATION

A. Identify components and provide warning signs as specified in Division 16 Section Electrical Identification."

3.3 FIELD QUALITY CONTROL

A. Perform electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.2. Certify compliance with test parameters.

B. Test and adjust controls and safeties.

3.4 FOLLOW-UP SERVICE

A. Voltage Monitoring and Adjusting: Perform the following voltage monitoring after Substantial Completion but not more than six months after Final Acceptance:

1. During a period of normal load cycles, perform seven days of continuous three-phase voltage recording at secondary terminals of each transformer. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from nominal value by more than plus or minus 5 percent during test period, is unacceptable.
2. Corrective Actions: If test results are unacceptable, perform the following corrective actions, as appropriate:

a. Adjust transformer taps.
b. Prepare written request for voltage adjustment by electric utility.

3. Retests: After corrective actions have been performed, repeat monitoring until satisfactory results are obtained.
4. Report: Prepare written report covering monitoring and corrective actions performed.

END OF SECTION 16271

SECTION 16341
MEDIUM-VOLTAGE SWITCHGEAR

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal-enclosed interrupter switchgear and metal-clad, circuit-breaker switchgear.

1.2 SUBMITTALS

A. Product Data: For each type of switchgear and related equipment, include the following:

1. Rated capacities, operating characteristics, furnished specialties, and accessories for individual interrupter switches and circuit breakers.
2. Time-current characteristic curves for overcurrent protective devices.

B. Shop Drawings: For each type of switchgear and related equipment, include the following:

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show method of field assembly and location and size of each field connection.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation at indicated ampere ratings for the following conditions:

1. Ambient temperature not exceeding 140 deg F (60 deg C).
2. Altitude of 1000 ft. above sea level.
3. Wet Locations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MANUFACTURED UNITS

A. Description: Factory assembled and tested, and complying with IEEE C37.20.1.

B. Ratings: Suitable for application in 3-phase, 60-Hz, solidly grounded-neutral system.

C. System Voltage: 34.5 kV nominal; 38 kV maximum.

2.3 METAL-ENCLOSED INTERRUPTER SWITCHGEAR

A. Available Manufacturers:

1. ABB Control, Inc.
2. Eaton Corporation; Cutler-Hammer Products.
3. S&C Electric Company.
4. Siemens Energy & Automation, Inc.
5. Square D; Schneider Electric.

B. Comply with IEEE C37.20.3.

C. Comply with IEEE C37.20.7. Provide arc-resistant switchgear, Type [1] [2] [1C] [2C].

D. Design Level of Available-Source Fault Current: Integrated short-circuit rating consistent with value of fault current indicated.

E. Main-Bus Rating: 2000 A, continuous.

F. Interrupter Switches: Stationary, gang operated, and suitable for application at maximum short-circuit rating of integrated switchgear assembly.

1. Rating: 1200-A continuous duty and load break.
2. Duty-Cycle, Fault Closing: 40,000 asymmetrical A.

G. Mechanical Interlock: Prevent opening door unless switchblades are open, and prevent closing switch if door is open.

H. Window: Permit viewing switchblade positions.

I. Power Fuses: Comply with applicable requirements in NEMA SG 2:

1. Indicator: Integral with each fuse to indicate when it has blown.
2. Current-Limiting Fuses: Full-range, fast-replaceable, current-limiting type.
3. Expulsion Fuses: Furnished in disconnect-type mountings and renewable with replacement fuse units.

2.4 METAL-CLAD, CIRCUIT-BREAKER SWITCHGEAR

A. Available Manufacturers:

1. ABB Control, Inc.
2. Eaton Corporation; Cutler-Hammer Products.
3. General Electric Distribution & Control.
4. Siemens Energy & Automation, Inc.
5. Square D; Schneider Electric.

B. Comply with IEEE C37.20.3.

C. Comply with IEEE C37.20.7. Provide arc-resistant switchgear, Type [1] [2] [1C] [2C].

D. Nominal Interrupting-Capacity Class: 750 MVA.

E. Main-Bus Rating: 3000 A, continuous.

F. Circuit Breakers: Three-pole, single-throw, electrically operated, drawout-mounting units using three individual, vacuum-sealed interrupter modules and including the following features:

1. Designed to operate at rated voltage to interrupt fault current within its rating within three cycles of trip initiation.
2. Contact-Wear Indicator: Readily accessible to field maintenance personnel.
3. Minimum of six Type A and six Type B spare contacts.
4. Interchangeability: Circuit breakers are interchangeable with vacuum circuit breakers of same current and interrupting ratings.

   a. Current Rating of Main Circuit Breaker: 2000 A.
   b. Continuous Current Rating of Tie Circuit Breaker: 2000 A.
   c. Continuous Current Rating of Feeder Circuit Breaker: 1200 A.

5. Operating Mechanism: Electrically charged, mechanically and electrically trip-free, stored-energy operated.

   a. Control Power: 125 -V dc for closing and tripping.
   b. Control Power: 120 -V ac for closing and tripping.
   c. Provide shunt trip capability independent of overcurrent trip.

G. Test Accessories: Relay and meter test plugs.

H. Low-DC-Voltage Alarm: Switchgear shall have a monitor for dc control power voltage with a remote alarm located where indicated. Alarm shall sound if voltage falls to an adjustable value to indicate an impending battery failure. Factory set alarm value at 80 percent of full-charge voltage.

I. Grounding and Testing Device: Suitable for phasing out, testing, and grounding switchgear bus or feeder if device is installed in place of circuit breaker. Include the following:

1. Portable grounding and testing device.
2. System control cabinet permanently mounted near switchgear.
3. Portable Remote-Control Station: For grounding and testing device.
4. Control-cabinet coupler cable.
5. Remote-Control Coupler Cable: 50 feet (15 m) long.
6. Permanent Control Power Wiring: From control cabinet to power source.
7. Protective cover.
8. Approval of Grounding and Testing Device System: Obtain approval of final system design from utility company and agency designated by Owner.

J. Circuit-Breaker Test Cabinet: Separately mounted and containing push buttons for circuit-breaker closing and tripping, control relay, fuses, and secondary coupler with cable approximately 108 inches (2740 mm) long. Include a set of secondary devices for operating circuit breaker if removed from switchgear and moved near test cabinet. Include provision for storage of test and maintenance accessories in cabinet.

K. Remote-Tripping Device: Wall-mounting emergency control station to open circuit breakers; located in red cast-metal box with break-glass operation.

2.5 FABRICATION

A. Indoor Enclosure: Steel.

B. Finish: Manufacturer's standard gray finish over rust-inhibiting primer on phosphatizing-treated metal surfaces.

C. Bus Transition Unit: Arranged to suit bus and adjacent units.

D. Auxiliary Compartments: Arranged to suit house meters, relays, controls, and auxiliary equipment; isolated from medium-voltage components.

E. Key Interlocks: Arranged to effect interlocking schemes indicated.

2.6 COMPONENTS

A. Buses: Aluminum, tin plated; full length of switchgear.

B. Bus Insulation: Covered with flame-retardant insulation.

C. Instrument Transformers: Comply with IEEE C57.13.

1. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
2. Current Transformers: Burden and accuracy class suitable for connected relays, meters, and instruments.

D. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems, listed and labeled by an NRTL, and with the following features:

1. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
2. Switch-selectable digital display with the following features:

    a. Phase Currents, Each Phase: Plus or minus 1 percent.
    b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    d. Three-Phase Real Power: Plus or minus 2 percent.
    e. Three-Phase Reactive Power: Plus or minus 2 percent.
    f. Power Factor: Plus or minus 2 percent.
    g. Frequency: Plus or minus 0.5 percent.
    h. Integrated Demand, with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
    i. Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.

3. Communications module suitable for remote monitoring of meter quantities and functions. Interface communication and metering requirements according to Division 16 Section "Electrical Power Monitoring and Control."
4. Mounting: Display and control unit that is flush or semiflush mounted in instrument compartment door.

E. Relays: Comply with IEEE C37.90, integrated digital type; with test blocks and plugs.

F. Surge Arresters: Distribution class, metal-oxide-varistor type. Comply with NEMA LA 1.

1. Install in cable termination compartments in each phase of circuit.
2. Coordinate rating with circuit voltage.

G. Provision for Future Devices: Equip compartments with rails, mounting brackets, supports, necessary appurtenances, and bus connections.

H. Control Power Supply: DC battery system.

I. Control Power Supply: Control power transformer supplies 120-V control circuits through secondary disconnect devices. Include the following features:

1. Dry-type transformers, in separate compartments for units larger than 3 kVA, including primary and secondary fuses for current-limiting and overload protection.

J. Control Wiring: Factory installed, complete with bundling, lacing, and protection.

2.7 CONTROL BATTERY SYSTEM

A. System Requirements: Battery shall have number of cells and ampere-hour capacity based on an initial specific gravity of 1.210 at 25 deg C with electrolyte at normal level and minimum ambient temperature of 13 deg C. Cycle battery before shipment to guarantee rated capacity on installation. Arrange battery to operate ungrounded.

B. Battery: Lead-calcium type in sealed, clear plastic or glass containers, complete with electrolyte, fully charged and arranged for shipment with electrolyte in cells. Limit weight of each container to not more than 70 lb (32 kg) and cells per container to not more than 3. System batteries shall be suitable for service at an ambient temperature ranging from minus 18

to 25 deg C. Limit variation of current output to 0.8 percent for each degree below 25 deg C down to minus 8 deg C.

C. Rack: Two-step rack with electrical connections between battery cells and between rows of cells; include two flexible connectors with bolted-type terminals for output leads.

D. Accessories:

1. Thermometers with specific-gravity correction scales.
2. Hydrometer syringes.
3. Set of socket wrenches and other tools required for battery maintenance.
4. Wall-mounting, nonmetallic storage rack fitted to store above items.
5. Set of cell numerals.

E. Charger: Static-type silicon rectifier equipped with automatic regulation and provision for manual and automatic adjustment of charging rate. Unit shall automatically maintain output voltage within 0.5 percent from no load to rated charger output current, with ac input-voltage variation of plus or minus 10 percent and input-frequency variation of plus or minus 3 Hz. Other features of charger include the following:

1. DC ammeter.
2. DC Voltmeter: Maximum error of 5 percent at full-charge voltage; operates with toggle switch to select between battery and charger voltages.
3. Ground Indication: Two appropriately labeled lights to indicate circuit ground, connected in series between negative and positive terminals, with midpoint junction connected to ground by normally open push-button contact.
4. Capacity: Sufficient to supply steady load, float-charge battery between 2.20 and 2.25 V per cell and equalizing charge at 2.33 V per cell.
5. Charging-Rate Switch: Manually operated switch provides for transferring to higher charging rate. Charger operates automatically after switch operation until manually reset.
6. AC power supply is 120 V, 60 Hz, subject to plus or minus 10 percent variation in voltage and plus or minus 3-Hz variation in frequency. After loss of ac power supply for any interval, charger automatically resumes charging battery. Charger regulates rate of charge to prevent damage due to overload and to prevent fuses or circuit breakers from opening.
7. Protective Feature: Current-limiting device or circuit, which limits output current to rating of charger but does not disconnect charger from either battery or ac supply; to protect charger from damage due to overload, including short circuit on output terminals.
8. Electrical Filtering: Reduces charger's audible noise to less than 26 dB.

2.8 IDENTIFICATION

A. Mimic Bus: Continuous mimic bus applied to front of switchgear, arranged in single-line diagram format, using symbols and lettered designations consistent with approved final mimic-bus diagram. Coordinate mimic-bus segments with devices in switchgear sections to which applied to produce a concise visual presentation of principal switchgear components and connections.

1. Medium: Painted graphics, as approved.
2. Color: Contrasting with factory-finish background; selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor switchgear assembly to 4-inch (100-mm), channel-iron sill embedded in concrete base and attach by bolting.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no less than 3 inches (75 mm) in all directions beyond the maximum dimensions of switchgear, unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 16 Section "Electrical Supports and Seismic Restraints."

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Diagram and Instructions:

1. Frame under clear acrylic plastic on front of switchgear.

a. Operating Instructions: Printed basic instructions for switchgear, including control and key-interlock sequences and emergency procedures.
b. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads.

3.3 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect switchgear, wiring, components, connections, and equipment installation. Test and adjust components and equipment.
2. Assist in field testing of equipment including pretesting and adjusting of automatic power factor correction units.
3. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:

a. Switchgear.

b. Circuit breakers.
c. Protective relays.
d. Instrument transformers.
e. Metering and instrumentation.
f. Ground-fault systems.
g. Battery systems.
h. Surge arresters.
i. Capacitors.

D. Remove and replace malfunctioning units and retest as specified above.

3.4 ADJUSTING

A. Set field-adjustable, protective-relay trip characteristics.

3.5 PROTECTION

A. Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

END OF SECTION 16341

SECTION 16430
SWITCHGEAR

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal-enclosed, low-voltage power circuit-breaker switchgear rated 1000 V and less for use in ac systems.

1.2 SUBMITTALS

A. Product Data: For each type of switchgear, circuit breaker, accessory, and component indicated.

B. Shop Drawings: For each type of switchgear and related equipment.

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

   a. Mimic-bus diagram.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that switchgear, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based.

D. Field quality-control test reports.

E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Inc.
2. Cutler-Hammer, Inc.; Eaton Corporation.
3. General Electric Company.
4. Siemens Energy & Automation, Inc.
5. Square D; Schneider Electric.

2.2 RATINGS

A. Nominal System Voltage: 480/277 V, 4 wire, 60 Hz.

B. Main-Bus Continuous: 4000 A.

C. Short-Time and Short-Circuit Current: Match rating of highest-rated circuit breaker in switchgear assembly.

2.3 FABRICATION

A. Factory assembled and tested and complying with IEEE C37.20.1.

B. Indoor Enclosure: Steel with removable, hinged, rear cover panels to allow access to rear interior of switchgear.

1. Section barriers between main and circuit-breaker compartments shall be extended to rear of section.
2. Bus isolation barriers shall be arranged to isolate line bus from load bus at each main circuit breaker.
3. Circuit-breaker compartments shall be equipped to house drawout-type circuit breakers and shall be fitted with hinged outer doors.
4. Finish: IEEE C37.20.1, manufacturer's standard gray finish over a rust-inhibiting primer on phosphatizing-treated metal surfaces.
5. Auxiliary Compartments: Match and align with basic switchgear assembly. Include the following:

a. Utility metering compartment that complies with utility company requirements.
b. Bus transition sections.
c. Incoming-line pull sections.
d. Hinged front panels for access to metering, accessory, and blank compartments.

C. Bus bars connect between vertical sections and between compartments. Cable connections are not permitted.

1. Neutral Bus: 100 percent of phase-bus ampacity, except as indicated. Equip bus with pressure-connector terminations for outgoing circuit neutral conductors.
2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy.
3. Circuit-Breaker Line Connections to Phase Bus: Use tin-plated aluminum for connecting to aluminum bus.
4. Feeder Circuit-Breaker Load Terminals: Silver-plated copper bus extensions equipped with pressure connectors for outgoing circuit conductors.
5. Ground Bus: Hard-drawn copper of 98 percent minimum conductivity, with pressure connector for feeder and branch-circuit ground conductors, minimum size 1/4 by 2 inches (6 by 50 mm).
6. Neutral Disconnect Link: Bolted, uninsulated, 1/4-by-2-inch (6-by-50-mm) bus, arranged to connect neutral bus to ground bus.

2.4 COMPONENTS

A. Instrument Transformers: Comply with IEEE C57.13.

1. Potential Transformers: Secondary-voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
2. Current Transformers: Ratios as indicated; burden and accuracy class suitable for connected relays, meters, and instruments.

B. Multifunction Digital-Metering Monitor: UL-listed or -recognized, microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following:

a. Phase Currents, Each Phase: Plus or minus 1 percent.
b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
d. Three-Phase Real Power: Plus or minus 2 percent.
e. Three-Phase Reactive Power: Plus or minus 2 percent.
f. Power Factor: Plus or minus 2 percent.
g. Frequency: Plus or minus 0.5 percent.
h. Integrated Demand, with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
i. Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Relays: Comply with IEEE C37.90, types and settings as indicated; with test blocks and plugs.

D. Surge Arresters: Distribution class, metal-oxide-varistor type. Comply with IEEE C62.11 and NEMA LA 1.

1. Install in cable termination compartments and connect in each phase of circuit.

E. Provision for Future Devices: Equip compartments with rails, mounting brackets, supports, necessary appurtenances, and bus connections.

F. Control Power Supply: Control power transformer supplying 120-V control circuits through secondary disconnect devices. Include the following features:

1. Dry-type transformers, in separate compartments for units larger than 3 kVA, including primary and secondary fuses.
2. Control Power Fuses: Primary and secondary fuses with current-limiting and overload protection.

G. Control Wiring: Factory installed, complete with bundling, lacing, and protection; and complying with the following:

1. Flexible conductors for No. 8 AWG and smaller, for conductors across hinges and for conductors for interconnections between shipping units.
2. Conductors sized according to NFPA 70 for duty required.

2.5 CIRCUIT BREAKERS

A. Description: Comply with IEEE C37.13.

B. Ratings: As indicated for continuous, interrupting, and short-time current ratings for each circuit breaker; voltage and frequency ratings same as switchgear.

C. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:

1. Normal Closing Speed: Independent of both control and operator.
2. Slow Closing Speed: Optional with operator for inspection and adjustment.
3. Stored-Energy Mechanism: Electrically charged, with optional manual charging.
4. Operation counter.

D. Trip Devices: Solid-state, overcurrent trip-device system consisting of one or two current transformers or sensors per phase, a release mechanism, and the following features:

1. Functions: Long-time-delay, short-time-delay, and instantaneous-trip functions, independent of each other in both action and adjustment.
2. Temperature Compensation: Ensures accuracy and calibration stability from minus 5 to plus 40 deg C.
3. Field-adjustable, time-current characteristics.
4. Current Adjustability: Dial settings and rating plugs on trip units or sensors on circuit breakers, or a combination of these methods.
5. Three bands, minimum, for long-time- and short-time-delay functions; marked "minimum," "intermediate," and "maximum."
6. Pickup Points: Five minimum, for long-time- and short-time-trip functions. Equip short-time-trip function for switchable I^2t operation.
7. Pickup Points: Five minimum, for instantaneous-trip functions.

8. Ground-fault protection with at least three short-time-delay settings and three trip-time-delay bands; adjustable current pickup. Arrange to provide protection for the following:

    a. Three-wire circuit or system.
    b. Four-wire circuit or system.
    c. Four-wire, double-ended substation.

9. Trip Indication: Labeled, battery-powered lights or mechanical targets on trip device to indicate type of fault.

E. Auxiliary Contacts: Two Type "a" and two Type "b" contacts wired through secondary disconnect devices to a terminal block in stationary housing.

F. Drawout Features: Circuit-breaker mounting assembly equipped with a racking mechanism to position circuit breaker and hold it rigidly in connected, test, and disconnected positions. Include the following features:

1. Interlocks: Prevent movement of circuit breaker to or from connected position when it is closed, and prevent closure of circuit breaker unless it is in connected, test, or disconnected position.
2. Circuit-Breaker Positioning: An open circuit breaker may be racked to or from connected, test, and disconnected positions only with the associated compartment door closed unless live parts are covered by a full dead-front shield. An open circuit breaker may be manually withdrawn to a position for removal from the structure with the door open. Status for connection devices for different positions includes the following:

    a. Test Position: Primary disconnect devices disengaged, and secondary disconnect devices and ground contact engaged.
    b. Disconnected Position: Primary and secondary devices and ground contact disengaged.

G. Arc Chutes: Readily removable from associated circuit breaker when it is in disconnected position, and arranged to permit inspection of contacts without removing circuit breaker from switchgear.

H. Padlocking Provisions: For installing at least three padlocks on each circuit breaker to secure its enclosure and prevent movement of drawout mechanism.

I. Operating Handle: One for each circuit breaker capable of manual operation.

J. Electric Close Button: One for each electrically operated circuit breaker.

K. Key Interlocks: Arranged so keys are attached at devices indicated. Mountings and hardware are included where future installation of key-interlock devices is indicated.

L. Undervoltage Trip Devices: Instantaneous, with adjustable pickup voltage.

M. Undervoltage Trip Devices: Adjustable time delay and pickup voltage.

N. Shunt-Trip Devices: Where indicated.

2.6 ACCESSORIES

A. Accessory Set: Furnish tools and miscellaneous items required for circuit-breaker and switchgear test, inspection, maintenance, and operation.

1. Racking handle to manually move circuit breaker between connected and disconnected positions.
2. Portable test set for testing all functions of circuit-breaker, solid-state trip devices without removal from switchgear.
3. Relay and meter test plugs suitable for testing switchgear meters and switchgear class relays.

B. Circuit-Breaker Removal Apparatus: Portable, floor-supported, roller-base, elevating carriage arranged for moving circuit breakers in and out of compartments.

C. Circuit-Breaker Removal Apparatus: Overhead-circuit-breaker lifting device, track mounted at top front of switchgear and complete with hoist and lifting yokes matching each size of drawout circuit breaker installed.

D. Spare-Fuse Cabinet: Identified and compartmented steel box or cabinet with lockable door.

E. Storage for Manual: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

2.7 IDENTIFICATION

A. Mimic Bus: Continuous mimic bus, arranged in single-line diagram format, using symbols and lettered designations consistent with approved mimic-bus diagram.

1. Mimic-bus segments coordinated with devices in switchgear sections to which applied, to produce a concise visual presentation of principal switchgear components and connections.
2. Medium: Painted graphics, as selected by Architect.
3. Color: Contrasting with factory-finish background; as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with applicable portions of NECA 400.

B. Anchor switchgear assembly to 4-inch (100-mm), channel-iron floor sill embedded in concrete base and attach by bolting.

1. Sills: Select to suit switchgear; level and grout flush into concrete base.
2. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 16 Section "Electrical Supports and Seismic Restraints" for seismic-restraint requirements.
3. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of

switchgear unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 16 Section "Electrical Supports and Seismic Restraints."

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Diagram and Instructions:

1. Frame and mount under clear acrylic plastic on the front of switchgear.

   a. Operating Instructions: Printed basic instructions for switchgear, including control and key-interlock sequences and emergency procedures.

2. Storage for Maintenance: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

3.3 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect switchgear installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
2. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 16 Sections.
3. Complete installation and startup checks according to manufacturer's written instructions.
4. Assist in field testing of equipment including pretesting and adjusting of equipment and components.
5. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:

   a. Switchgear.
   b. Circuit breakers.
   c. Protective relays.
   d. Instrument transformers.
   e. Metering and instrumentation.
   f. Ground-fault systems.

g. Surge arresters.

2. Remove and replace malfunctioning units and retest as specified above.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchgear. Remove front and rear panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchgear 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switchgear checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 ADJUSTING

A. Set field-adjustable, protective-relay trip characteristics.

END OF SECTION 16430

SECTION 16442
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

D. Field quality-control reports.

E. Panelboard schedules for installation in panelboards.

F. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

E. Mains: Fused switch.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.

G. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

H. Branch Overcurrent Protective Devices: Fused switches.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

F. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. External Control-Power Source: 120-V branch circuit.

G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

a. Instantaneous trip.
b. Long- and short-time pickup levels.
c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."
    f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 16 Section "Fuses."

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

I. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 16 Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 16442

SECTION 16521
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.2 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports and supporting structure, applied as stated in AASHTO LTS-4.

B. Ice Load: Load of 3 lbf/sq. ft. (143.6 Pa), applied as stated in AASHTO LTS-4.

C. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.

1. Wind speed for calculating wind load for poles exceeding 50 feet (15 m) in height is 110 mph (177 km/h).
2. Wind speed for calculating wind load for poles 50 feet (15 m) or less in height is 110 mph (177 km/h).

1.3 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Include anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

2.1 MANUFACTURERS

A. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
3. Basis of Design Product: The design of each item of exterior luminaire and its support is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Color as selected by Architect. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

N. Factory-Applied Finish for Aluminum Luminaires: Color shall be black. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with NEMA C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 FLUORESCENT BALLASTS AND LAMPS

A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures 0 deg F (minus 18 deg C) and higher.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: A, except B for T12/HO ballasts.
3. Total Harmonic Distortion Rating: Less than 10percent.
4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
6. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F (minus 18 deg C) and higher.

D. Fluorescent Lamps: Low-mercury type. Comply with the EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

2.5 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction average life. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.

a. Restrike Range: 105- to 130-V ac.
b. Maximum Voltage: 250-V peak or 150-V ac RMS.

2. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).

2.6 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.

B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000K.

C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000K.

D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.7 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-4.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

2.8 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); 1-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.

1. Shape: Round, tapered.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms: Davit type, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.

F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 16 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Color shall be as selected by Architect.

2.9 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access handhole in pole wall.

B. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

C. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 16 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

D. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
2. Finish: Same as luminaire.

E. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

F. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Color shall be as selected by Architect from manufacturer's full range.

2.10 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 16 Section "Wiring Devices" for ground-fault circuit-interrupter type.

1. Recessed, 12 inches (300 mm) above finished grade.
2. Nonmetallic polycarbonate plastic or reinforced fiberglass cover that when mounted results in NEMA 250, Type 4X enclosure.
3. With cord opening.
4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.

C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

D. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept ballast(s).

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.2 POLE INSTALLATION

A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
3. Trees: 15 feet (5 m).

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 3 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers, unless otherwise indicated.
4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Dig holes large enough to permit use of tampers in the full depth of hole.
2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.

2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3 Section "Cast-in-Place Concrete."

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

A. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3 Section "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 16 Section "Raceways and Boxes." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 GROUNDING

A. Ground metal poles and support structures according to Division 16 Section "Grounding and Bonding."

1. Install grounding electrode for each pole, unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 16 Section "Grounding and Bonding."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

END OF SECTION 16521

SECTION 16600
MARINA SLIP UTILITY PEDESTALS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for Dockside Utility Centers (DUC) for use on the floating dockage system.

1.02 REFERENCES

A. National Electrical Code, NEC Article 555 Marinas and Boatyards.

B. National Fire Protection Association, NFPA 303, Fire Protection Standards for Marinas and Boatyards.

C. Underwriter's Laboratories, UL Specification 231, Power Outlets.

1.03 SUBMITTALS

A. Product Data:
   1. Furnish descriptive drawings for DUC in configurations identical to those required for this project.
   2. Furnish parts, installation and maintenance instructions to Owner.

1.04 QUALITY ASSURANCE

A. Qualification:
   1. Design Criteria:
      a. DUC shall be UL listed and meet the requirements of NFPA 303 and NEC Article 555.
      b. DUC shall withstand 500 pound Horizontal impact to the DUC without dislodging from its mounting.
      c. The base shall be no more than 15 inches square.

   2. Acceptable Manufactures:
      a. HYPOWER PowerPort. (800) 677-0955.
      b. Will-Burt, Ensign Plus (800) 334-5904.
      c. International Dock Products, Inc., S. King Fulton Standard model (800) 909-3625.
      d. Lighthouse SS, Eaton Marina Power & Lighting,800-723-8009
      e. Engineer approved equal.

1.05 WARRANTY

A. Manufacturer to warrantee against defects in parts or workmanship for a minimum of one year from Owner's acceptance of the installation.

PART 2 - PRODUCTS

2.01 STRUCTURAL MATERIALS

A. DUC body shall be one of the following:

1. Powder coated stainless steel (Type 304).
2. Lexan Polycarbonate or polycarbonate equivalent.
3. Powder coated aluminum (Type 6036).

B. The body shall be flame retardant, corrosion, impact and UV resistant. The body shall be capable of withstanding the harsh marine environment.

C. DUC shall be full height body, post mounted DUC are not acceptable.

2.02 RECEPTACLES

A. DUC shall utilize marine-grade corrosion-resistant, grounding and locking type receptacles which conform to NEMA requirements.

B. Receptacles shall be mounted at a downward angle from the horizontal plane to minimize stress on the power cord and connection.

C. Receptacles shall be mounted at least 30 inches above deck.

D. Receptacles shall be twist-lock type in configuration.

E. The receptacles for each slip within the utility pedestal shall be wired to two opposed phases of the three-phase power distribution system.

2.03 BREAKERS

A. The circuit breakers shall be of thermal/magnetic type.

B. Individual circuit breaker protection shall be utilized for each receptacle.

C. Circuit breakers shall be covered to ensure proper weather and security protection.

D. Circuit breakers shall be located at least 30 inches above the deck surface.

2.04 LIGHTING

A. DUC be equipped with a LED light source oriented to illuminate the deck.

B. DUC lens shall be yellow or amber.

C. The lumen pattern from the diffuser will not interfere or impede navigation and/or docking in berths.

D. The light shall be controlled by a fuse-protected photo-electric sensor contained within the unit.

2.05 WIRING/GROUNDING

A. DUC shall be factory-wired of standard copper wire and provide isolation between the high and low voltage equipment.

B. DUC shall provide a terminal block to accommodate loop feed or tap connections for single phase power with a separate ground block.

C. Access to the terminal block shall be provided by an access panel to allow for proper terminations.

D. Access doors shall be provided on the low voltage side to allow for connection and inspection of all low voltage wiring.

E. All exposed metal parts shall have an internal ground that is part of the equipment grounding system.

2.06 PLUMBING

A. DUC shall include two 3/4 inch hose-bibs with copper supply piping.

B. Hose bibs shall have anti-siphon devices.

C. The hose-bibs shall be at least 14.5 inches above the deck.

D. DUC shall have two brackets capable of holding 50 feet of 5/8 inch water hose.

PART 3 - EXECUTION

3.01 MOUNTING

A. The base shall be secured to the deck surface by stainless steel lag screws or by stainless steel bolts, washers shall be stainless steel. If concrete paver decking is used, use a 1’ x 2’ concrete paver plus a 1’ x 2’ diamond plate in place of a 2’ x 2’ concrete paver to cover the opening around the DUC. Secure the DUC directly to the diamond plate, and secure the diamond plate to the dock frame. Diamond plate shall be flush with the decking surface. Diamond plate shall be stainless steel, hot-dipped galvanized steel, or aluminum.

B. DUC shall be mounted as close to dock edge as practicable.

END OF SECTION

SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. [Fire-resistance-rated, watertight] [Watertight]sleeve-seal systems.
4. Grout.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Cast-in-place watertight device for protecting penetrating objects from expansion and contraction of concrete. Factory-assembled for use in cast-in-place concrete floors and walls and consisting of two outer sleeves and a one-piece radial extended-flange waterstop gasket, with mid-body seal for embedment and sealing to concrete slab and continuous water seal extending to the penetrating pipe.

E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide [1-inch (25-mm)] <Insert dimension> annular clear space between piping and concrete slabs and walls.

1. When cast-in-place watertight sleeve seals are required, select sleeve size to match the size and type of pipe to be installed.

2. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas [2 inches (50 mm)] <Insert dimension> above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sealsfor the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and larger: Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and larger: Galvanized-steel-pipe sleeves.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and larger: Galvanized-steel-pipe sleeves.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and larger: Galvanized-steel-pipe sleeves.

END OF SECTION 22 0517

SECTION 22 0519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Meters and gages

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design this project element, including comprehensive engineering analysis by a qualified design professional, to meet or exceed the program requirements, performance requirements, code compliance, applicable ASTM quality standard, and design criteria as outlined and / or referenced within this RFP package.

1.4 SUBMITTALS

A. Not used.

1.5 QUALITY ASSURANCE

A. Not used.

PART 2 - PRODUCTS

2.1 METERS AND GAGES

A. Temperature and indicator ranges for services required. Accuracy of thermometers shall be ± 1%.

1. Mercury In-Glass Thermometers: Die-cast, aluminum finished, glass front, mercury filled tube with magnifying lens.
2. Direct-Mount Filled-System Dial Thermometers: Vapor actuated, universal angle, drawn steel or cast aluminum case with glass lens.
3. Remote Reading Filled-System Dial Thermometers: Vapor actuated, universal angle, drawn steel or cast aluminum case with glass lens.
4. Bimetal Dial Thermometers: Direct mounted, bimetal, universal angle type with stainless steel case and glass lens.
5. Dial-Type Insertion Thermometers: Bimetal, stainless steel case and stem.
6. Thermometers Wells: Brass or stainless steel, pressure rated to match piping system design pressure.
7. Pressure Gages: General use, ASME B4Q.1, Grade A, phosphor-bronze, Bourdon-tube type, drawn steel or brass case, glass lens.

8. Pressure Gage Accessories: Brass tubing straight coil siphon; brass snubber with disc suitable for fluid served and rated pressure.
9. Flow meters to be noninvasive ultrasound type.
10. BTU Meters: Turbine wheel flow meter, temperature sensors, calculator with integral battery pack, bronze housing, ± 1% accuracy.
11. Test Plugs: Nickel plated brass body, self-sealing valve type core inserts.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner to engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in compliance with CO-7 DB section 16.

END OF SECTION 22 0519

SECTION 22 0523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following Valves:

1. Gate valves.
2. Ball valves.
3. Plug valves.
4. Butterfly valves
5. Swing check valves.
6. Wafer check valves.
7. Lift check valves.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design this project element, including comprehensive engineering analysis by a qualified design professional, to meet or exceed the program requirements, performance requirements, code compliance, applicable ASTM quality standard, and design criteria as outlined and / or referenced within this RFP package.

1.4 SUBMITTALS

A. Not used.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

2.2 VALVES

A. General duty valves in cast iron, bronze and brass, fabricated to comply with Manufacturer's Standardization Society (MSS) classification listed. Gate, globe, ball, butterfly and plug valves for shutoff duty; globe, ball and plug valves for throtlling duty.

1. Gate valves, 2–inch and smaller, for Chilled Water, Domestic Hot and Cold Water service: MSS SP–80, Class 125 or Class 150, cast bronze, threaded or soldered ends, based upon service requirements.
2. Gate valves, 2–inch and smaller, for Heating Hot Water, Steam service: MSS SP–80, Class 150, cast bronze, threaded or soldered ends, based upon service requirements.
3. Gate valves, 2 ½–inch and larger: MSS SP–70, Class 125, iron body, flanged ends.
4. Ball valves, 1–inch and smaller: Rated for 150 psi saturated steam service, 400 psi water–oil–gas (WOG) service, 2–piece construction, bronze body, threaded or soldered ends, based upon service requirements.
5. Ball valves, 1 ¼–inch to 2–inch: Rated for 150 psi saturated steam service, 400 psi WOG, 3–piece construction, bronze body, threaded or soldered ends, based upon service requirements.
6. Plug valves, 2–inch and smaller: Rated at 150 psi WOG, bronze body, threaded ends.
7. Plug valves, 2 1/2–inch and larger: MSS SP–78, rated at 175 psi WOG, semi–steel body, flanged ends.
8. Globe valves, 2–inch and smaller: MSS SP–80, Class 125 or Class 150, cast bronze.
9. Globe valves, 2 1/2–inch and larger: MSS SP–85, Class 125, iron body.
10. Butterfly valves, 2 1/2–inch and larger: MSS SP–67, rated at 200 psi, cast iron body, field replaceable sleeve, stainless steel stem, lug or wafer type, based upon service requirements.
11. Swing check valves, 2–inch and smaller: MSS SP–80, Class 125 or Class 150, cast iron body and cap, threaded or soldered ends, based upon service requirements.
12. Swing check valves, 2 1/2–inch and larger: MSS SP–71, Class 125, cast iron body and cap, flanged ends.
13. Wafer check valves: Class 250, cast iron body, to open with one foot differential pressure.
14. Lift check valves, 2–inch and smaller: Class 125, cast bronze body and cap, threaded ends.
15. Gate valves, 2–inch and smaller: Used for general shutoff application on all High Temperature Hot Water systems shall be Class 600 psi, ASTM A–216–WCB steel body and bonnet, with 600 psi socket weld ends, solid disc, copper–silicon alloy stem, brass packing gland, Teflon® impregnated packing, and malleable iron handwheel. Provide Class 600 psi valves meeting the above specifications where system operating pressure and test pressures allow.
16. Gate valves, 65–mm and larger: Used for shutoff application on all High Temperature Hot Water systems shall be Class 600, ASTM A–216–WCB steel body, mounted, with body and bonnet conforming to ASTM A–216–WCB with flanged ends, Teflon®

impregnated packing and two piece backing gland assembly, with mose ends, flex wedge, inside screw, rising stem and provided cap and chain. Grease fittings shall be supplied for shaft packing.

17. Ball valves, 1–inch and smaller: Class 600 psi, two piece construction, with steel body conforming to ASTM B62, conventional port, chrome plated brass ball , replaceable Teflon® or TFE seats and seals, blowout–proof stem and vinyl covered steel handle. Provide solder ends for hot water service. Provide socket weld ends on medium and high pressure steam and condensate service valves.
18. Ball valves, for hot water service, to 6–inches: Class 600 psi, three piece construction, with steel body conforming to ASTM B62, conventional port, chrome plated brass ball , replaceable Teflon® or TFE seats and seals, blowout–proof stem and vinyl covered steel handle. Provide socket weld ends for high temperature hot water service. Ball seats and stem must be easily replaced without removing valve pipe connections from line. Leakproof at all pressures up to 600 psi. Construction of valve shall allow for actuator, if needed. Valve stem shall be blowout proof.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner to engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in compliance with CO-7 DB section 16.

END OF SECTION 22 0523

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes hangers and supports for mechanical systems piping and equipment.

1.3 DEFINITIONS

A. Terminology used in this Section is defined in MSS SP-90.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division

1. Specification Sections.

B. Product data for each type of hanger and support.

C. Submit pipe hanger and support schedule showing manufacturer's Figure No., size, location, and features for each required pipe hanger and support.

D. Shop drawings for each type of hanger and support, indicating dimensions, weights, required clearances, and methods of component assembly.

1.5 QUALITY ASSURANCE

A. Qualify welding processes and welding operators according to AWS D1.1 "Structural Welding Code--Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. NFPA Compliance: Comply with NFPA 13 for hangers and supports used as components of fire protection systems.

C. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70, Article 100.

1. UL and FM Compliance: Hangers, supports, and components include listing and labeling by UL and FM where used for fire protection piping systems.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Hangers, Supports, and Components: Factory-fabricated according to MSS SP-58.

1. Components include galvanized coatings where installed for piping and equipment that will not have a field-applied finish.
2. Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) average compressive strength, waterproofed calcium silicate, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.

C. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

2.2 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36 (ASTM A 36M), steel plates, shapes, and bars, black and galvanized.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Grout: ASTM C 1107, Grade B, nonshrink, nonmetallic.

1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic-cement-type grout that is nonstaining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

3. Water: Potable.
4. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in the Section specifying the equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping specification Sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. General: Comply with MSS SP-69 and SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible.

C. Install supports with maximum spacings complying with MSS SP-69.

D. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

E. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Install reinforcing bars through openings at top of inserts.

F. Install concrete inserts in new construction prior to placing concrete.

G. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (100 mm) thick.

H. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (100 mm) thick.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Heavy-Duty Steel Trapezes: Field-fabricate from ASTM A 36 steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

K. Support fire protection systems piping independent of other piping.

L. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.

O. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

3. Shields: Install MSS Type 40, protective shields on cold piping with vapor barrier. Shields span an arc of 180 degrees (3.1 rad) and have dimensions in inches (mm) not less than the following:

NPS (Inches)	LENGTH (Inches)	THICKNESS (Inches)
1/4 to 3-1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 to 14	24	0.075
16 to 24	24	0.105

PIPE SIZE (DN)	LENGTH (mm)	THICKNESS (mm)
8 to 90	300	1.22
100	300	1.52
125 and 150	450	1.52
200 to 350	600	1.91
400 to 600	600	2.67

4. Pipes 8 Inches (DN 200) and Larger: Include wood inserts.
5. Insert Material: Length at least as long as the protective shield.

6. Thermal-Hanger Shields: Install with insulation of same thickness as piping.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make a smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint and paint exposed areas immediately after erection of hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal is specified in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 0529

SECTION 22 0548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Vibration control.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design this project element, including comprehensive engineering analysis by a qualified design professional, to meet or exceed the program requirements, performance requirements, code compliance, applicable ASTM quality standard, and design criteria as outlined and / or referenced within this RFP package.

1.4 SUBMITTALS

A. Not used.

1.5 QUALITY ASSURANCE

A. Not used.

PART 2 - PRODUCTS

2.1 VIBRATION CONTROL

A. Fiberglass pads and shapes.

B. Neoprene pads.

C. Vibration isolation springs.

D. Pad type isolators.

E. Plate type isolators.

F. Double plate type isolators.

G. Threaded double plate type isolators.

H. Directional anchors.

I. Neoprene mountings.

J. Free standing spring isolators.

K. Housed spring isolators.

L. Vertically restrained spring isolators.

M. Earthquake resistant spring isolators.

N. Seismic snubbers.

O. Thrust restraints.

P. Equipment rails.

Q. Fabricated equipment bases.

R. Inertia base frames.

S. Roof-curb isolators.

T. Isolation hangers.

U. Riser isolators.

V. Flexible pipe connectors, suitable for use.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner to engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in compliance with CO-7 DB section 16.

END OF SECTION 22 0548

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Mechanical Identification

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design this project element, including comprehensive engineering analysis by a qualified design professional, to meet or exceed the program requirements, performance requirements, code compliance, applicable ASTM quality standard, and design criteria as outlined and / or referenced within this RFP package.

1.4 SUBMITTALS

A. Not used.

1.5 QUALITY ASSURANCE

A. Not used.

PART 2 - PRODUCTS

2.1 MECHANICAL IDENTIFICATION

A. Conforming to ASME A13.1, as applicable, color coded, of the following types:

1. Standard stencils.
2. Snap on plastic markers.
3. Pressure sensitive pipe markers.
4. Plastic duct markers.
5. Plastic tape.
6. Valve tags.
7. Valve tag fasteners.
8. Access panel markers.
9. Valve schedule frames.
10. Engraved plastic laminate signs.
11. Plastic equipment markers.
12. Plasticized tags suitable for use.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner to engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in compliance with CO-7 DB section 16.

END OF SECTION 22 0553

SECTION 22 0716 - PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Work specified elsewhere.

1. Basic materials and methods.
2. Piping systems.
3. Air distribution equipment.

1.3 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildew.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.5 DELIVERY AND STORAGE

A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers clearly labeled with flame and smoke ratings.

PART 2 - PRODUCTS

2.1 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.2 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

2.3 A sample quantity of each type insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.4 Glass fiber materials as manufactured by Owens/Corning, PPG, CSG, or Johns Manville will be acceptable, if they comply with the specifications.

2.5 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

A. Flame Spread 25

B. Smoke Developed 50

2.6 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.7 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.1 All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION 22 0716

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 REFERENCES

A. ASTM B209: Aluminum and Aluminum-Alloy Sheet and Plate

B. ASTM C534: Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C. ASTM C547: Mineral Fiber Preformed Pipe Insulation

D. ASTM C553: Mineral Fiber Blanket and Felt Insulation

E. ASTM C921: Properties of Jacketing Materials for Thermal Insulation

F. ASTM E84: Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

A. Submit under provisions of Section 15000

B. Product Data: For each product used in this project, provide catalog data for insulation, jackets and accessories, and installation instructions.

C. Samples: Not required

1.3 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84.

B. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Store insulation in original wrapping, and protect from weather and construction traffic.

C. Protect insulation against dirt, water, chemical and mechanical damage.

PART 2 - PRODUCTS

2.1 RIGID FIBER GLASS INSULATION

A. Provide molded, heavy density, noncombustible; one-piece pipe insulation made from inorganic glass fibers bonded with a thermosetting resin with K-value shall be 0.24 at 75°F per ASTM C547.

B. Provide factory installed, all service jacket of white kraft paper bonded to aluminum foil and reinforced with glass fibers and self-sealing lap for longitudinal seam and butt strips for circumferential joints per ASTM C921.

C. Provide 18-ga, Type 304 stainless steel tie wire with twisted ends on 24" centers but not less than two-tie wires per insulation section.

D. For fittings and valves, provide one-piece, molded, 20-mil thick, PVC covers with fiberglass inserts.

1. Use pressure sensitive, color matching vinyl tape to seal PVC fitting covers to jacket of insulation per ASTM C921

2.2 FLEXIBLE FIBER GLASS INSULATION

A. Provide flexible, noncombustible, blanket insulation made from highly resilient, inorganic glass fibers bonded by a thermosetting resin.

1. Density shall be 1.0 lb/cu ft. K-value shall be 0.28 at 75(F per ASTM C553

B. Provide factory applied, foil-scrim-kraft vapor barrier with 2" wide stapling flange.

1. Secure seams with outward clinching staples on 6" centers.
2. Seal seams with two coats of vapor barrier mastic reinforced with 4" wide, open weave glass fabric per ASTM C921.

2.3 CELLULAR FOAM INSULATION

A. Provide flexible, closed-cell, slit tubing form, elastomeric pipe insulation.

1. For large diameter pipe, provide sheet form.
2. K-value shall be 0.27 at 75(F.
3. Use contact adhesive to seal longitudinal seams and circumferential joints per ASTM C534.

B. For fittings and valves, fabricate insulation from mitered-cut tubular form using contact adhesive to seal joints.

C. If necessary, provide two layers of insulation to obtain specified thickness, staggering the longitudinal and circumferential joints.

2.4 ALUMINUM JACKET

A. For pipes, provide 16 mil thick, stucco embossed pattern finish, Type 1100 aluminum jacket, ASTM B209 and for horizontal pipe, locate longitudinal lap on bottom.

B. For fittings, provide 24-mil thick, die shaped, smooth finish, Type 1100 aluminum jacket, ASTM B209.

C. Provide 0.5" wide, 20-mil thick, Type 3003 aluminum bands on maximum 24" centers but not less than two bands per jacket section.

2.5 SHIELDS AND INSERTS

A. At all pipe hangers or pipe supports, provide 12" long, 180(arc, galvanized sheet metal shields matching the insulation outside dimension.

B. For pipes larger than 2" diameter, provide 12" long, 180(arc, cellular glass insulation inserts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before applying insulation, verify the following:

1. The inspection, testing and approval of piping are complete.
2. The surfaces are clean (all foreign material removed) and dry.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. On exposed insulation provide jacket or finish, and locate longitudinal seams in least visible locations.

1. Where insulated piping extends to weather exposed areas, provide specified aluminum sheet metal jacket.

C. Piping insulation or covering shall not penetrate fire-rated assembly unless the specific material has been tested an approved as part of the fire-rated assembly.

D. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.

E. For above grade applications, maintain 0.5" air space on all sides of the insulation.

F. Finish insulation at supports, protrusions, and interruptions.

G. Storm Water Pipe (Interior and Above Grade Applications)

1. For roof drain bodies, provide 2" thick, flexible fiberglass insulation.
2. For horizontal drains, provide 1" thick, rigid fiberglass insulation.
3. For vertical leaders, insulation is not required.
4. Seal all seams with vapor barrier mastic.

5. Insulate all fittings per Article 2.1.D.

H. Domestic Hot Water Pipe (Interior and Above Grade Applications): For hot water supply and return pipes, provide 1" thick, rigid fiberglass insulation.

I. Domestic Cold Water Pipe: Insulation is not required.

J. Condensate Pipe (Interior and Above Grade Applications): Provide 3/4" thick, cellular foam insulation.

END OF SECTION 22 0719

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water distribution piping from locations indicated to fixtures and equipment inside building.

B. Related Sections include the following:

1. Division 2 Section "Water Systems" for exterior water service piping.
2. Division 2 Section "Water Systems" for exterior water service piping and water meters.
3. Division 22 for water meters, thermometers, pressure gages, fittings, thermometers, pressure gages, and fittings, and water distribution piping specialties.

1.3 DEFINITIONS

A. Water Service Piping: Water piping outside building that conveys water to building.

B. Service Entrance Piping: Water piping at entry into building between water service piping and water distribution piping.

C. Water Distribution Piping: Water piping inside building that conveys water to fixtures and equipment throughout the building.

D. The following are industry abbreviations for plastic piping materials:

1. CPVC: Chlorinated polyvinyl chloride.
2. NP: Nylon.
3. PB: Polybutylene.
4. PE: Polyethylene.
5. PP: Polypropylene.
6. PVC: Polyvinyl chloride.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Combined Fire-Protection and Domestic, Service Entrance Piping: 250 psig (1725 kPa).
2. Service Entrance Piping: 160 psig (1100 kPa).
3. Water Distribution Piping: 125 psig (860 kPa).

1.5 SUBMITTALS

A. Water Samples, Test Results, and Reports: Specified in "Field Quality Control" and "Cleaning" articles.

1.6 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping.

D. Comply with NSF 61, "Drinking Water System Components--Health Effects," Sections 1 through 9 for potable-water piping and components.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES

A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

2.2 PIPE AND TUBE FITTINGS

A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

B. Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper.

C. Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.

D. Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends. Include threads conforming to ASME B1.20.1 on threaded ends.

2.3 JOINING MATERIALS

A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

B. Refer to Division 22 Section "Common Results for Plumbing" for commonly used joining materials.

C. Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

D. Copper, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.

D. Underground, Service Entrance Piping: Do not use flanges or valves underground. Use the following:

1. 2-Inch and Smaller: ASTMB 88, Soft copper tube, Type K soft drawn copper, solder-joint pressure fittings; and soldered joints.

2. 2-1/2 and 3”: ASTM B 88, Type K hard drawn copper, solder-joint pressure fittings; and soldered joints.

3. 4” and Larger: AWWA C900, PVC pipe, ASTM F477 gaskets, ASTM D3139 joints, Pressure Class 165 psi (DR 25)

E. Aboveground, Water Distribution Piping: Use the following:

1. 2” and Smaller: ASTM B 88, Type L, water tube, drawn copper, solder-joint pressure fittings; and soldered joints.

2. 2-1/2- and Larger: ASTM B 88, Type L, water tube, drawn copper, solder-joint pressure fittings; and soldered joints.

F. Underground, Water Distribution Piping: Do not use flanges or valves underground. Use the following:

1. 2-Inch and Smaller: ASTM B 88, Soft copper tube, Type K soft drawn copper, solder-joint pressure fittings; and soldered joints.

2. 2-1/2- and larger: ASTM B 88, Type K hard drawn copper, solder-joint pressure fittings; and soldered joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves.
2. Throttling Duty: Use ball valves.

3.4 PIPING INSTALLATION, GENERAL

A. Refer to Division 22 Section "Common Results for Plumbing" for basic piping installation.

3.5 SERVICE ENTRANCE PIPING INSTALLATION

A. Extend service entrance piping to exterior water service piping in sizes and locations indicated for service entrances into building.

B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each service entrance pipe.

C. Install water-pressure regulators downstream from shutoff valves.

D. Ductile-Iron, Service Entrance Piping: Comply with AWWA C600. Install buried piping between shutoff valve and connection to water service piping with restrained joints. Anchor pipe to wall or floor at entrance. Include thrust-block supports at vertical and horizontal offsets.

1. Encase piping with polyethylene film according to ASTM A 674 or AWWA C105.

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Common Results for Plumbing" for sleeves and mechanical sleeve seals.

3.6 WATER DISTRIBUTION PIPING INSTALLATION

A. Install piping level without pitch.

B. Fitting Option for Hard Copper Tube: Mechanically formed tee-branch outlets may be used instead of tee fittings.

3.7 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Results for Plumbing" for basic piping joint construction.

B. Mechanically Formed Outlets: Form tee in copper tube according to equipment manufacturer's written instructions. Use tool designed for copper tube, drill pilot hole, form collar for outlet, dimple tube forming seating stop, and braze branch tube into collar.

C. Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Solvent-Cemented, Thermoplastic Pipe and Fitting Joints: Handle cleaners, primers, and solvent cements according to ASTM F 402.

3.8 VALVE INSTALLATION

A. Sectional Valves: Install sectional valves close to main on each branch and riser serving plumbing fixtures or equipment, and where indicated. Use ball valves for piping 2-inch NPS (DN50) and smaller.

B. Shutoff Valves: Install shutoff valve on each water supply to equipment, on each supply to plumbing fixtures without supply stops, and where indicated. Use ball valves for piping 2-inch NPS (DN50) and smaller.

C. Drain Valves: Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated. Use ball valve for piping 2-inch NPS (DN50) and smaller.

E. Calibrated Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated.

3.10 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices. Install the following:

1. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
2. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.
3. Adjustable roller hangers, MSS Type 43, for individual, straight, horizontal runs longer than 100 feet (30 m).
4. Spring cushion rolls, MSS Type 49, if indicated, for individual, straight, horizontal runs longer than 100 feet (30 m).

5. Pipe rolls, MSS Type 44, for multiple, straight, horizontal runs 100 feet (30 m) or longer. Support pipe rolls on trapeze.
6. Spring hangers, MSS Type 52, for supporting base of vertical runs.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. 3/4-Inch NPS (DN20) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
2. 1-Inch NPS (DN25): Maximum horizontal spacing, 72 inches (1800 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
3. 1-1/4-Inch NPS (DN32): Maximum horizontal spacing, 72 inches (1800 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).
4. 1-1/2 and 2-Inch NPS (DN40 and DN50): Maximum horizontal spacing, 96 inches (2400 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).

3.10 CONNECTIONS

A. Connect service entrance piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

B. Connect water distribution piping to service entrance piping at shutoff valve, and extend to and connect to the following:

1. Booster Systems: Connect cold-water suction and discharge piping.
2. Water Heaters: Connect cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Connect hot- and cold-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
4. Equipment: Connect hot- and cold-water supply piping as indicated. Provide shutoff valve and union for each connection.

3.11 FIELD QUALITY CONTROL

A. Inspect service entrance piping and water distribution piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

    a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test service entrance piping and water distribution piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
3. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.12 CLEANING

A. Clean and disinfect service entrance piping and water distribution piping as follows:

1. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.

c. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

D. Prepare and submit reports for purging and disinfecting activities.

E. Clean interior of piping system. Remove dirt and debris as work progresses.

3.13 COMMISSIONING

A. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

B. Perform the following steps before putting into operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

D. Check plumbing specialties and verify proper settings, adjustments, and operation.

1. Water-Pressure Regulators: Set outlet pressure at 80 psig (550 kPa) maximum, unless otherwise indicated.

E. Energize pumps and verify proper operation.

END OF SECTION 22 1116

SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Water meters..
2. Backflow preventers.
3. Water pressure regulators.
4. Thermostatic water mixing valves.
5. Water tempering valves.
6. Miscellaneous piping specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design this project element, including comprehensive engineering analysis by a qualified design professional, to meet or exceed the program requirements, performance requirements, code compliance, applicable ASTM quality standard, and design criteria as outlined and / or referenced within this RFP package.

1.4 SUBMITTALS

A. Not used.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9.

PART 2 - PRODUCTS

2.1 WATER METERS

A. American Water Works Association C700-C710 series, register in gallons.

1. Each building to be metered separately.

2.2 BACKFLOW PREVENTERS

A. American Society of Safety Engineers (ASSE) Standard backflow preventers for flow rate and maximum pressure loss required, 150 psig minimum working pressure.

2.3 WATER PRESSURE REGULATORS

A. ASSE 1003, initial working pressure 150 psig, minimum.

2.4 THERMOSTATIC WATER MIXING VALVES

A. ASSE 107, manually adjustable. The use of thermostatic mixing valves shall be limited to one per building and shall be located in the main mechanical rooms, fully accessible.

2.5 WATER TEMPERING VALVES

A. Manually adjustable, thermostatically controlled. The use of thermostatic mixing valves shall be limited to one per building and shall be located in the main mechanical rooms, fully accessible.

2.6 MISCELLANEOUS PIPING SPECIALTIES

A. Strainers, hose bibbs, wall hydrants, post hydrants, hose end drain valves, water hammer arresters. All hydrants located outside or on exterior of building shall be frost-proof. Provide a minimum of two frostproof wall hydrants on each side of each building and at a minimum spacing of 200 feet between hydrants. Wall hydrants shall include a locking box and be equipped with a shutoff valve located at inside of building.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner to engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in compliance with CO-7 DB section 16.

END OF SECTION 22 1119

SECTION 22 1316 - SANITARY WASTE AND VENT PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sanitary drainage and vent piping, and storm drainage piping inside building and to locations indicated.

B. Related Sections include the following:

1. Division 2 Section "Sewerage and Drainage" for sanitary sewerage and storm drainage.
2. Division 2 Section "Foundation Drainage Systems" for foundation drains.
3. Division 2 Section "Interceptors" for sewerage and drainage system interceptors.

1.3 DEFINITIONS

A. Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.

B. Drainage Piping: Building sewer piping outside building that conveys storm drainage from building.

C. Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.

D. Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.

E. Force-Main Piping: Drainage piping, under pressure.

F. The following are industry abbreviations for plastic and other piping materials:

1. ABS: Acrylonitrile-butadiene-styrene.
2. EPDM: Ethylene-propylene-diene polymer, rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PVC: Polyvinyl chloride.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Systems: 10-foot head of water (30 kPa).

2. Storm Drainage Systems: 10-foot head of water (30 kPa).
3. Sewage, Force-Main Piping Systems: 100 psig (690 kPa).

1.5 SUBMITTALS

A. Test Results and Reports: Specified in "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES

A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

B. Hub-and-Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service and Extra Heavy classes. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.

C. Hubless, Cast-Iron Soil Pipe: ASTM A 888 or CISPI 301.

D. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

E. Hard Copper Tube: ASTM B 306, drainage tube, drawn temper.

F. PVC Plastic Pipe: ASTM D 2665, Schedule 40.

2.2 PIPE AND TUBE FITTINGS

A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

B. Threaded-Fitting, End Connections: ASME B1.20.1.

C. Hubless, Cast-Iron, Soil-Pipe Fittings: CISPI 301.

D. Cast-Iron Sovent Fittings: ASME B16.45 drainage-pattern aerator and deaerator.

E. Copper, Solder-Joint Drainage Fittings: ASME B16.23 cast copper or ASME B16.29 wrought copper.

F. Copper Sovent Fittings: ASME B16.32 cast copper, drainage-pattern aerator and deaerator.

G. Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper. Furnish wrought-copper fittings if indicated.

H. Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.

I. Bronze Flanges: ASME B16.24, Class 150, bronze, with solder-joint end.

J. Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.

K. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket joint, metal-to-metal bronze seating surfaces, and female threaded ends with threads according to ASME B1.20.1.

L. Cast-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

M. Cast-Iron, Threaded Drainage Fittings: ASME B16.12, galvanized, recessed, drainage pattern.

N. Cast-Iron, Threaded Flanges: ASME B16.1, Class 125.

O. Steel, Grooved-End Fittings: ASTM A 47 (ASTM A 47M) malleable-iron casting, ASTM A 106 steel pipe, or ASTM A 536 ductile-iron casting with dimensions matching steel pipe.

P. Ferrous Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe section, and flanged ends.

Q. Ferrous, Double Expansion Joints: Compound, galvanized steel fitting with telescoping body and 2 slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

R. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311 drain, waste, and vent pipe patterns.

S. PVC Plastic, Tubular Fittings: ASTM F 409 drainage pattern, with ends as required for application.

2.3 JOINING MATERIALS

A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

B. Refer to Division 22 Section "Common Results for Plumbing" for commonly used joining materials.

C. Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

D. Hubless, Cast-Iron, Soil-Piping Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve or gasket with integral, center pipe stop. Include the following:

1. Heavy-Duty, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel housing or shield; and stainless-steel clamps. Include gasket.

a. Clamp Width: 3 inches (75 mm) wide with 4 clamps, for piping 1-1/2- to 4-inch NPS (DN40 to DN100).
b. Clamp Width: 4 inches (100 mm) wide with 6 clamps, for piping 5- to 10-inch NPS (DN125 to DN250).

E. Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

F. Flexible, Transition Couplings for Underground, Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends same sizes as piping to be joined and include corrosion-resistant metal band on each end.

1. Sleeve Type for Plain-End Piping: Rubber or elastomeric sleeve and stainless-steel band assembly, fabricated to match outside diameters of piping to be joined. Include the following:

a. Sleeves for Cast-Iron Soil Piping: ASTM C 564 rubber.
b. Sleeves for Plastic Piping: ASTM F 477 elastomeric seal.
c. Sleeves for Dissimilar Piping: Compatible with piping materials to be joined.
d. Bands: Stainless steel, one at each pipe insert.

2. Gasket Type for Dissimilar-End Piping: Rubber or elastomeric compression gasket, made to match inside diameter of pipe or hub, and outside diameter of adjoining pipe. Include the following:

a. Gaskets for Cast-Iron Soil Piping: ASTM C 564 rubber.
b. Gaskets for Plastic Piping: ASTM F 477 elastomeric seal.
c. Gaskets for Dissimilar Piping: Compatible with piping materials to be joined.

2.4 VALVES

A. Refer to Division 22 Section "General Duty Valves for Plumbing Piping" for general-duty valves. Use valves specified for "Domestic Water Systems" applications.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Above- and below-ground, Soil, Waste, and Vent Piping: Use the following:

1. Cast-iron sovent fittings where indicated.
2. Copper sovent fittings where indicated.

3. 1-1/2-Inch NPS (DN40): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and one of the following hubless, cast-iron, soil-piping couplings:

a. Couplings: Heavy-duty, Type 304, stainless steel.
b. Couplings: Heavy-duty, FM-approved, Type 304, stainless steel.
c. Couplings: Heavy-duty, cast iron.
d. Couplings: Heavy-duty, Type 301, stainless steel.
e. Couplings: Compact, Type 301, stainless steel.
f. Couplings: Compact, Type 304, stainless steel.

4. 1-1/4- and 1-1/2-Inch NPS (DN32 and DN40): PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.

5. 2- to 4-Inch NPS (DN50 to DN100): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and one of the following hubless, cast-iron, soil-piping couplings:

a. Couplings: Heavy-duty, Type 304, stainless steel.
b. Couplings: Heavy-duty, FM-approved, Type 304, stainless steel.
c. Couplings: Heavy-duty, cast iron.
d. Couplings: Heavy-duty, Type 301, stainless steel.
e. Couplings: Compact, Type 301, stainless steel.
f. Couplings: Compact, Type 304, stainless steel.

D. Above- and below-ground, Storm Drainage and Forced Main Piping: Use the following:

2. 2- to 4-Inch NPS (DN50 to DN100): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and one of the following hubless, cast-iron, soil-piping couplings:

a. Couplings: Heavy-duty, Type 304, stainless steel.
b. Couplings: Heavy-duty, FM-approved, Type 304, stainless steel.
c. Couplings: Heavy-duty, cast iron.
d. Couplings: Heavy-duty, Type 301, stainless steel.

8. 2- to 4-Inch NPS (DN50 to DN100): PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves.
2. Throttling Duty: Use ball valves.

B. Grooved-end butterfly valves may be used with grooved-end piping.

3.4 PIPING INSTALLATION, GENERAL

A. Refer to Division 22 Section "Common Results for Plumbing" for basic piping installation.

3.5 SERVICE ENTRANCE PIPING INSTALLATION

A. Refer to Division 2 Section "Sewerage and Drainage" for sanitary and storm sewer piping.

B. Extend building sanitary drain piping and connect to sanitary sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building sanitary drains with building sanitary sewers.

C. Extend building storm drain piping and connect to storm sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building storm drains and building storm sewers.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Common Results for Plumbing" for sleeves and mechanical sleeve seals.

E. Install wall penetration system at each service entrance pipe penetration through foundation wall. Make installation watertight. Refer to Division 22 Section "Common Results for Plumbing" for wall penetration systems.

3.6 DRAINAGE AND VENT PIPING INSTALLATION

A. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

B. Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not make change in direction of flow greater than 90 degrees. Use proper size of standard

increasers and reducers if different sizes of piping are connected. Reducing size of drainage piping in direction of flow is prohibited.

C. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

D. Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Sanitary Building Drain: 2 percent downward in direction of flow for piping 3-inch NPS (DN80) and smaller; 1 percent downward in direction of flow for piping 4-inch NPS (DN100) and larger.
2. Horizontal, Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Storm Building Drain: 1 percent downward in direction of flow.
4. Horizontal, Storm Drainage Piping: 2 percent downward in direction of flow.
5. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

E. Install engineered, sanitary drainage and vent systems in locations indicated and as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

2. Copper, Sovent, Single Stack: Comply with CDA 402/0, "Brass and Bronze Design Handbook, Single-Stack Plumbing System."
3. Cast-Iron, Sovent, Single Stack: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
4. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

F. Install engineered, controlled-flow, storm drainage systems in locations indicated. Comply with standards of authorities having jurisdiction.

G. Sleeves are not required for cast-iron soil piping passing through concrete slab on grade if slab is without membrane waterproofing.

H. Install PVC plastic drainage piping according to ASTM D 2665.

I. Install underground, PVC plastic drainage piping according to ASTM D 2321.

3.7 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Results for Plumbing" for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Compression Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. PVC Piping Joints: Join drainage piping according to ASTM D 2665.

E. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling during joining of plastic pipe and fittings.

3.8 VALVE INSTALLATION

A. Shutoff Valves: Install shutoff valve on each pump discharge and where indicated. Use gate or ball valves for piping 2-inch NPS (DN50) and smaller.

B. Check Valves: Install swing check valve on each pump discharge, downstream from shutoff valve.

3.9 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices. Install the following:

3.10 CONNECTIONS

A. Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.

B. Connect drainage piping to service entrance piping, and extend to and connect to the following:

1. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
2. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection.

C. Connect force-main piping to service entrance piping, and extend to and connect to the following:

1. Sump Pumps: Connect force-main piping to sump-pump discharge.
2. Sewage Pumps: Connect force-main piping to sewage-pump discharge.

3.11 FIELD QUALITY CONTROL

A. Inspect drainage and vent piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
3. Roughing-In Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 feet of head (30 kPa). Water level must not drop from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

C. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.12 CLEANING AND PROTECTING

A. Clean interior of piping system. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of water-based latex paint.

END OF SECTION 22 1316

SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Miscellaneous piping specialties.
4. Sleeve penetration assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design this project element, including comprehensive engineering analysis by a qualified design professional, to meet or exceed the program requirements, performance requirements, code compliance, applicable ASTM quality standard, and design criteria as outlined and / or referenced within this RFP package.

1.4 SUBMITTALS

A. Not used.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cast iron cleanouts, comply with ASME A112.36.2M.

2.2 FLOOR DRAINS

A. Cast iron floor drains, comply with ASME 112.21.1M.

B. Cast iron trench drains, comply with ASME A112.21.1M

C. Cast iron open drains, cast iron deep seal traps and related fittings.

2.3 MISCELLANEOUS PIPING SPECIALTIES

A. Sanitary hydrants, stop and waste drain valves, trap seal primer valves, horizontal backwater valves, drain outlet backwater valves, air admittance valves, stack flashing fittings, vent caps, vent terminals, roof flashing assemblies.

2.4 SLEEVE PENETRATION SYSTEMS

A. Comply with UL 1479, through penetration firestop assembly.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Inspections shall be made in accordance with the requirements of the owner and Boone County.

B. Testing and Inspecting: Owner to engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in compliance with CO-7 DB section 16.

END OF SECTION 22 1319

SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS

1.1 GENERAL

A. Submit Product Data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories.

B. ASHRAE Standard: Comply with performance efficiencies prescribed in ASHRAE 90.1, "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings."

C. ASHRAE Standard: Comply with performance efficiencies prescribed in ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings."

D. NFPA Standard: Comply with NFPA 70, "National Electrical Code," for electrical components.

E. Listing and Labeling: Provide electrically operated water heaters, controls, and components specified in this Section that are listed and labeled.

1.2 PRODUCTS

A. Water Heaters, General: Manufacturer's standard components and features are acceptable where specific product requirements are not indicated. Include the following:

1. Temperature Control: Adjustable thermostat, except for units where other arrangement is indicated or temperature is regulated by flow-control fitting.
2. Safety Control: Automatic, high-temperature-limit cutoff device or system on commercial units and where indicated. Include automatic low-water cutoff device or system on commercial units where indicated.
3. Interior Finish: Materials that comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.
4. Tappings: Factory fabricated of materials compatible with tank. Include tappings for piping connections, relief valves, pressure gage, thermometer, blow down, and controls as required and others as indicated. Attach tappings to tank before testing and labeling. Include tappings and connections as follows:

   a. 2-Inch NPS (DN50) and Smaller: Threaded ends.
   b. 2-1/2-Inch NPS (DN65) and Larger: Flanged ends.

5. Insulation: Fiberglass, polyurethane foam, or manufacturer's standard that is suitable for operating temperature and required insulating value. Include insulation material that surrounds entire tank except connections and controls.
6. Jacket: Steel, with baked-on enamel finish, except where otherwise specified.
7. Anode Rods: Factory installed, magnesium.
8. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

   a. Option: Separate temperature and pressure relief valves are acceptable instead of combination relief valve.
   b. Exception: Omit relief valve for tankless water heater. Include pressure relief valve for installation in piping.

B. Household, Storage, Electric Water Heaters: UL 174, with capacity more than 40 gal. (151 L), but not more than 120 gal. (454 L), and input not more than 12 kW.

1. Storage Tank Construction: Steel with 150-psig (1035-kPa) working-pressure rating.
2. Heating Elements: 2 electric, screw-in, immersion type.
3. Temperature Control: Adjustable thermostat for each element. Include wiring arrangement for nonsimultaneous operation.
4. Heat Traps: Manufactured, factory- or field-installed, cold-type inlet fitting in inlet and hot-type outlet fitting in outlet of household water heater.
5. Drain Valve: ASSE 1005, factory or field installed. Omit when water heater is without drain outlet and include general-duty drain valve in piping.
6. Vacuum Relief Valve: Comply with ASME PTC 25.3. Furnish for installation in piping. Omit where water heater has integral vacuum relieving device.

C. Household, Point-of-Use, Storage, Electric Water Heaters: UL 174, with capacity not less than 6 gal. (22.7 L), but not more than 40 gal. (151 L), and input not more than 12 kW.

1. Storage Tank Construction: Steel with 150-psig (1035-kPa) working-pressure rating.
2. Heating Elements: 2, except when 1 is indicated; electric, screw-in, immersion type.
3. Heat Traps: Manufactured, factory- or field-installed, cold-type inlet fitting in inlet and hot-type outlet fitting in outlet of household water heater.
4. Drain Valve: ASSE 1005, factory or field installed. Omit when water heater is without drain outlet and include general-duty drain valve in piping.
5. Vacuum Relief Valve: Comply with ASME PTC 25.3. Furnish for installation in piping. Omit where water heater has integral vacuum relieving device.

D. Point-of-Use, Tankless, Electric Water Heaters: Conforming to applicable requirements of UL 499.

1. Construction: Manufacturer's standard and without hot-water storage.
2. Working-Pressure Rating: 150 psig (1035 kPa).
3. Electric Heating System: Manufacturer's standard electric-resistance type.
4. Jacket: Aluminum or steel with baked-on enamel finish, or plastic.
5. Mounting: Bracket or device for wall mounting.
6. Temperature Control: Adjustable thermostat.
7. Temperature Control: Adjustable, microprocessor temperature-control thermostat for remote, wall-mounting installation. Include control wiring.
8. Temperature Control: Factory-set, temperature-control thermostat for fixed, outlet-water temperature.
9. Temperature Control: Flow-control fitting in inlet piping.
10. Safety Control: Automatic, high-temperature-limit cutoff.

E. Commercial, Point-of-Use, Storage, Electric Water Heaters: UL 174, but listed by manufacturer for commercial applications, or UL 1453, with capacity not less than 6 gal. (22.7 L), but not more than 40 gal. (151 L), and input not more than 12 kW.

1. Storage Tank Construction: Steel with 150-psig (1035-kPa) working-pressure rating.
2. Heating Elements: 2, except when 3 is indicated; electric, screw-in, immersion type.
3. Special Requirements: NSF 5 construction.
4. Inlet and Outlet Manifolds: Fabricated by water heater manufacturer and capable of providing balanced flow through water heaters, for multiple-unit installation.
5. Vacuum Relief Valve: Comply with ASME PTC 25.3. Furnish for installation in piping. Omit where water heater has integral vacuum relieving device.

F. Light-Commercial, Storage, Electric Water Heaters: UL 174, but listed by manufacturer for commercial applications, or UL 1453, with capacity more than 40 gal. (151 L), but not more than 120 gal. (454 L), and input not more than 12 kW.

1. Storage Tank Construction: Steel with 150-psig (1035-kPa) working-pressure rating.
2. Heating Elements: 2 electric, screw-in, immersion type wired for simultaneous operation.
3. Special Requirements: NSF 5 construction.
4. Inlet and Outlet Manifolds: Fabricated by water heater manufacturer and capable of providing balanced flow through water heaters, for multiple-unit installation.
5. Vacuum Relief Valve: Comply with ASME PTC 25.3. Furnish for installation in piping. Omit where water heater has integral vacuum relieving device.

G. Commercial, Storage, Electric Water Heaters: UL 1453, with capacity more than 40 gal. (151 L).

1. Storage Tank Construction: ASME labeled, steel with 150-psig (1035-kPa) working-pressure rating.
2. Storage Tank Construction: Steel with 150-psig (1035-kPa) working-pressure rating.
3. Heating Elements: Electric, screw-in or bolt-on, immersion type according to the following:

   a. Up to 9-kW Input: 2 or 3 elements.
   b. More than 9-kW Input: Elements arranged in multiples of 3.

4. Heating Elements: Electric, screw-in or bolt-on, immersion type arranged in multiples of 3.
5. Staging: Not exceeding 18 kW per step.
6. Temperature Control: Adjustable immersion thermostats.
7. Temperature Control: Adjustable surface-mounting thermostats.
8. Safety Control: Automatic, high-temperature-limit and low-water cutoffs.
9. Special Requirements: NSF 5 construction.
10. Inlet and Outlet Manifolds: Fabricated by water heater manufacturer and capable of providing balanced flow through water heaters, for multiple-unit installation.
11. Vacuum Relief Valve: Comply with ASME PTC 25.3. Furnish for installation in piping. Omit where water heater has integral vacuum relieving device.

1.3 EXECUTION

A. Install water heaters on concrete bases. Set and connect units according to manufacturer's written instructions. Install units plumb, level, and firmly anchored in locations indicated. Maintain manufacturer's recommended clearances. Install so controls and devices are accessible for service.

B. Install temperature and pressure relief valves in top portion of storage water heater tanks and hot-water storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge to closest floor drain.

C. Install pressure relief valves in hot-water-outlet piping for water heaters without storage. Extend relief valve outlet with water piping in continuous downward pitch and discharge to closest floor drain.

D. Install vacuum relief valves in cold-water-inlet piping.

E. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains.

F. Install thermometers on water heater inlet and outlet piping.

G. Install pressure gages on water heater piping when and as indicated.

H. Install inlet and outlet piping manifolds for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through water heaters. Include throttling valves in outlet manifolds and thermometers in inlet and outlet manifolds.

I. Install piping adjacent to water heaters to allow service and maintenance.

J. Arrange for field-applied insulation on equipment and piping not furnished with factory-applied insulation.

K. Connect hot- and cold-water piping to units with shutoff valves and unions. Connect hot-water circulating piping to unit with shutoff valve, check valve, and union.

L. Make connections with dielectric fittings where piping is made of dissimilar metals.

M. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections.

N. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values.

END OF SECTION

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SECTION 22 4000 - PLUMBING FIXTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Joint Sealants" for sealing between fixtures and walls, floors, and counters.
2. Division 22 Section "General Duty Valves for Plumbing Piping" for general-duty valves used as supply stops.
3. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers and other specialties not specified in this Section.

1.3 DEFINITIONS

A. Accessible: Plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped, disabled, and elderly people.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, traps and waste pipes. Pipe fittings, tube fittings, and general-duty valves are included where indicated.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each plumbing fixture category and type specified. Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

C. Wiring diagrams from manufacturer for electrically operated units.

D. Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category from one source and by a single manufacturer.

1. Exception: Where fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for this category.

B. Regulatory Requirements: Comply with requirements of Architectural and Transportation Barriers Compliance Board's (ATBCB) "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" regarding plumbing fixtures for physically handicapped people.

C. Energy Policy Act Requirements: Comply with requirements of Public Law 102-486, "Energy Policy Act," regarding water flow rate and water consumption of plumbing fixtures.

D. Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing fixtures and are based on specific types and models indicated. Other manufacturers' fixtures with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.

B. Store plumbing fixtures on elevated platforms in dry location.

1.7 PROJECT CONDITIONS

A. Field Measurements: Coordinate roughing-in and final fixture locations and verify that plumbing fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURE STANDARDS

A. Comply with applicable standards below and other requirements specified.

1. Electric Water Coolers: ARI 1010 and UL 399.

2. Emergency Equipment: ANSI Z358.1.
3. National Sanitation Foundation Construction: NSF 2.
4. Plastic Mop-Service Basins: ANSI Z124.6.
5. Plastic Shower Enclosures: ANSI Z124.2 and ANSI Z124.2a.
6. Semivitreous Ceramic Fixtures: ASME A112.19.9M.
7. Vitreous-China Fixtures: ASME A112.19.2M.

    a. Exception: ASME A112.19.9M, semivitreous, ceramic fixtures, except water-closet bowls and urinals with integral traps, may be furnished instead of vitreous-china fixtures.
8. Water-Closet, Flushometer Tank Trim: ASSE 1037.

2.2 LAVATORY/SINK FAUCET STANDARDS

A. Comply with ASME A112.18.1M and other requirements specified for lavatory, sink, and similar-type-fixture faucet fittings. Include hot- and cold-water indicators; 2.5-gpm- (0.16-L/s-) maximum flow rate; and polished, chrome-plated finish; except where otherwise indicated. Coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
2. Faucet Hose: ASTM D 3901.
3. Hose-Connection Vacuum Breakers: ASSE 1011.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
6. Pipe Threads: ASME B1.20.1.
7. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
8. Sink Spray Hoses: ASTM D 3573.

2.3 MISCELLANEOUS FITTING STANDARDS

A. Comply with ASME A112.18.1M and other requirements specified for fittings, other than faucets. Include polished, chrome-plated finish, except where otherwise indicated. Coordinate fittings with other components and connectors.

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Automatic Flow Restrictors: ASSE 1028.
3. Brass and Copper, Supplies and Tubular Brass: ASME A112.18.1M.
4. Fixed Flow Restrictors: ASSE 1034.
5. Manual-Operation Flushometers: ASSE 1037.
6. Plastic Tubular Fittings: ASTM F 409.

2.4 MISCELLANEOUS COMPONENT STANDARDS

A. Comply with applicable standards below and other requirements specified for components for plumbing fixtures, equipment, and appliances.

1. Floor Drains: ASME A112.21.1M.
2. Hose-Coupling Threads: ASME B1.20.7.

3. Hot-Water Dispensers: ASSE 1023 and UL 499.
4. Pipe Threads: ASME B1.20.1.
5. Plastic Shower Receptors: ANSI Z124.2 and ANSI Z124.2a.
6. Plastic Toilet Seats: ANSI Z124.5.
7. Supply and Drain Insulation Kits: CABO A117.1.
8. Supports: ASME A112.6.1M.

2.5 FITTINGS

A. Fittings for Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for materials for supplies, supply stops, supply risers, traps, and other fittings.

B. Fittings for Equipment Specified in Other Sections: Fittings include the following:

1. Supply Inlets: Brass pipe or copper tube, size required for final connection.

2. Supply Stops: Chrome-plated brass, angle or straight; compression, wheel-handle type; same size as supply inlet and with outlet matching supply riser.

3. Supply Risers: 3/8-inch NPS (DN10) flexible copper tube with knob end. Use chrome-plated tube for exposed applications.

4. Traps: Tubular brass with 0.045-inch (1.1 mm) wall thickness, slip-joint inlet, cleanout, wall flange, escutcheons, and size to match equipment. Use chrome-plated tube for exposed applications.
5. Continuous Waste: Tubular plastic with slip-joint inlet and size to match equipment.

6. Indirect Waste: Tubular plastic and size to match equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports match those indicated, before installing and connecting fixtures. Use manufacturer's roughing-in data when roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Include supports for plumbing fixtures according to the following:

1. Carriers: For wall-hanging water closets and fixtures supported from wall construction.
2. Chair Carriers: For wall-hanging urinals, lavatories, sinks, drinking fountains, and electric water coolers.

3. Heavy-Duty Chair Carriers: For accessible urinals, lavatories, and other fixtures where indicated.
4. Reinforcement: For floor-mounted lavatories and sinks that require securing to wall and recessed, box-mounted, electric water coolers.

5. Fabricate reinforcement from 2-by-4-inch or 2-by-6-inch (38-by-89-mm or 38-by-140-mm) fire-retardant-treated-wood blocking between studs or 1/4-by-6-inch (6.35-by-152.4-mm) steel plates attached to studs, in wall construction, to secure fixtures to wall. Include length that will extend beyond ends of fixture mounting bracket and attach to at least 2 studs.

B. Include fitting insulation kits for accessible fixtures according to the following:

1. Lavatories: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
2. Sinks: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
3. Fixtures with Offset Drain: Cover hot- and cold-water supplies, offset drain, trap, and waste to wall.
4. Other Fixtures: Cover exposed fittings below fixture.

3.3 PLUMBING FIXTURE INSTALLATION

A. Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.

B. Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.

C. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.

D. Install toilet seats on water closets.

E. Install wall-hanging, back-outlet urinals with gasket seals.

F. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for handicapped people to reach.

G. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

H. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.

I. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.

J. Fasten recessed, wall-mounted fittings to reinforcement built into walls.

K. Fasten wall-mounted fittings to reinforcement built into walls.

L. Fasten counter-mounting plumbing fixtures to casework.

M. Secure supplies to supports or substrate within pipe space behind fixture.

N. Set shower receptors and mop basins in leveling bed of cement grout.

O. Install individual stop valve in each water supply to fixture. Use gate or globe valve where specific stop valve is not specified.

1. Exception: Omit stop valves on supplies to emergency equipment, except when permitted by authorities having jurisdiction. When permitted, install valve chained and locked in OPEN position.

P. Install water-supply stop valves in accessible locations.

Q. Install faucet, laminar-flow fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.

R. Install supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

S. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.

T. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes, except where otherwise indicated.

U. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.

V. Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1-part, mildew-resistant, silicone sealant according to sealing requirements specified in Division 7 Section "Joint Sealants." Match sealant color to fixture color.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other Division 22 Sections.

B. Supply and Waste Connections to Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for fitting sizes and connection requirements for each plumbing fixture.

C. Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.

D. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified in Division 26 Sections. Plumbing contractor shall include any necessary wiring in their bid.

3.5 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.6 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flushometer valves having controls, to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Include the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities, except when approved in writing by Owner.

END OF SECTION 22 4000

SECTION 22 4700 – DRINKING FOUNTAINS AND WATER COOLERS

Part 1 - GENERAL

1.1 SUMMARY

.A. Section includes:

1. The supply and installation of washroom fixtures and trim.

B. Products installed but not supplied under this section:

1. Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
2. Equipment installed by others.

   a. Connect with unions.

.

3. Equipment not installed.

   a. Valved and capped for future connection by others.

1.2 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 35 29.06 - Health and Safety Requirements.

C. Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

D. Section 01 78 00 - Closeout Submittals.

1.3 REFERENCES

A. Air Conditioning and Refrigeration Institute (ARI)

1. ARI 1010, Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

B. Canadian Standards Association (CSA)

1. CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.
2. CAN/CSA-B125, Plumbing Fittings.
3. CAN/CSA-B651, Barrier-Free Design.

C. Province of Newfoundland and Labrador Building Accessibility Regulations.

1.4 SUBMITTALS

A. Submittals in accordance with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 62 00.01 - Hazardous Materials.

C. Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

D. Indicate for all fixtures:

1. Dimensions, construction details, roughing-in dimensions.

E. Closeout Submittals:

1. Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.
2. Include:

a. Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

b. Details of operation, servicing, maintenance.

c. List of recommended spare parts.

1.5 QUALITY ASSURANCE

A. Health and Safety:

1. Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY STORAGE AND DISPOSAL

A. Waste Management and Disposal:

1. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
2. Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
3. Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Fixtures: manufacture in accordance with CAN/CSA-B45 series.

B. Trim, fittings: manufacture in accordance with CAN/CSA-B125.

C. Exposed plumbing brass to be chrome plated.

D. Number, locations: Architectural drawings to govern.

2.2 DRINKING FOUNTAINS

A. DF-1: Recessed with elevated bubbler base, integral strainer, wall screws with washers and cap nuts, 18 gauge type 304 stainless steel no. 4 satin finish,front mounted push button valve.

1. Trim chrome plated: angle stream anti-squirt bubbler with automatic stream regulator, self-closing valve, screwdriver stop, waste tailpiece, trap, in-line strainer, chrome plated waste strainer

B. DF-2 : Wall-hung barrier free dual height 18 gauge stainless steel type 304, No. 4 satin finish, stainless steel back panel, integral chrome plated strainer, wall hanger.

1. Trim: chrome plated angle stream anti-squirt bubbler with in line strainer and automatic stream regulator, push button with two one piece fountains, with rounded bowls, self-closing valve, screwdriver stop, waste tailpiece, trap and access cover.

2.3 REFRIGERATED WATER COOLERS

A. RWC-1: Wall-mounted barrier free.

1. Refrigeration system: packaged hermetic R134a unit with pre-cooler, insulated double wall chiller, storage tank, air-cooled condenser, thermostatically controlled.

B. Capacity: 30 L/h from 27?C to 10?C, with 32?C ambient air. In accordance with ARI 1010.

C. Cabinet: two receptors dual height type 304 stainless steel, No. 4 satin finish, one piece rectangular bowls with rounded corners, integral back, 60 micron mesh strainer, access panel and grille, elevated bubbler base, chrome plated waste strainer.

D. Bubbler: chrome plated pushbutton operated, self-regulating, angle stream, squirt-proof, with nozzle and guard.

E. Electrical: grounded electrical cord with plug: 120 V, 60 Hz. CSA certified.

2.4 FIXTURE PIPING

A. Cold water supplies to each fixture:

1. Shut off valve in supply pipes each with handwheel stop, reducers, escutcheon.

B. Waste:

1. Brass P trap with cleanout on each fixture not having integral trap.

Part 3 - EXECUTION

3.1 INSTALLATION

A. Mounting heights:

1. Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
2. Wall-hung fixtures: measured from finished floor.
3. Physically handicapped: to comply with most stringent of either NBCC, CAN/CSA B651 or Provincial Building Accessibility Act and Regulations.

B. Drinking fountains and water coolers:

1. In accordance with ARI 1010.

3.2 ADJUSTING

A. Conform to water conservation requirements specified this section.

B. Adjustments.

1. Adjust water flow rate to design flow rates.
2. Adjust water cooler, drinking fountain flow stream to ensure no spillage.

C. Checks.

1. Refrigerated water coolers: operation, temperature settings.
2. Thermostatic controls. Verify temperature settings, operation of control, limit and safety controls.
3. Report checks and verifications in Commissioning Manual.

END OF SECTION 22 4700

SECTION 23 0100 – BASIC MECHANICAL REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions, (if any) and other General Requirements, apply to the work specified in this section.

B. Separation of Division 23 into Sections is for convenience only and is not intended to establish limits of work. Sections are as follows:

1. 230100 Basic Mechanical Requirements
2. 230513 Common Motor Requirements for HVAC Equipment
3. 230529 Hangers and Supports for HVAC Piping and Equipment
4. 230548 Vibration and Seismic Controls for HVAC Piping and Equipment
5. 230553 Identification for HVAC Piping and Equipment
6. 230593 Testing, Adjusting, and Balancing for HVAC
7. 230700 HVAC Insulation
8. 230900 Instrumentation and Control for HVAC
9. 230923 Variable Frequency Motor Controllers
10. 233113 Metal Ducts
11. 233300 Air Duct Accessories
12. 233423 HVAC Power Ventilators
13. 233600 Air Terminal Units
14. 233713 Diffusers, Registers, and Grilles
15. 237413 Packaged, Outdoor, Central-Station Air Handling Units
16. 238128 Ductless Split-System Air-Conditioners
17. 238239 Unit Heaters

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations and expands the requirements specified in Division 1. These requirements are: Contractor's Qualifications, Quality Assurance, Reference Codes and Standards, Permits and Inspections, Equipment and Materials, Examination of Premises, Submittals, Coordination Drawings, Record Documents, Project Closeout, Warranty, Measurements, Operation Prior to Substantial Completion, Contractor Operation Prior to Substantial Completion, Electrical Work, Painting, Protection of Equipment and Work, Rough-ins, Mechanical Installations, and Cutting and Patching.

1.3 DEFINITIONS

A. The following definitions apply to all Division 23 specification sections:

1. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
2. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing,

anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.

3. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.
4. Installer: The term "Installer" is defined as the entity (person or firm) engaged by the Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. Installers shall be skilled in the work they are to perform.
5. Specialist: The term "Specialist" means an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workmen skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the contract specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.
6. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
7. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
8. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
9. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
10. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SCOPE

A. The following requirements apply to the work necessary to provide air conditioning system or systems, as specified in the various sections of this Division.

1.5 CONTRACTOR'S QUALIFICATIONS

A. An acceptable contractor for the work under this Division shall be a specialist in this field and have the personal experience, training and skill and the organization to provide a practical working system. If required, he shall be able to furnish acceptable evidence of having contracted for and installed not less than 3 systems of comparable size and type to this one, that have served their owners satisfactorily for not less than 3 years. The foreman for this work shall have had experience in installing not less than 3 such systems and shall be approved before work is begun.

1.6 QUALITY ASSURANCE

A. Manufacturers:
   1. Trade names, manufacturers and catalog numbers are mentioned herein and on the Drawings solely in order to establish a standard for the type, general design and quality of product required. Other products similar in design, of equal quality and complying with the Drawings

and Specifications will be considered after the contract is let only for those items with which the expression "or approved equal" is used. Where two or more manufacturers or materials are named, the Contractor may submit any of those named, provided they conform to the Specification. Identification in the project documents of any product by name, manufacturer or model number does not include either expressed or implied warranty of unqualified product acceptance. All products must be capable of proper installation in the spaces provided, readily maintained and must satisfy other requirements contained in the contract documents.

2. If manufacturer and/or model number is indicated in the Contract Documents, it is for the purpose of identifying the product that is the “Basis of Design”. This means the product has been used as the basis for coordination for all architectural, structural, electrical, & mechanical requirements. If a manufacturer and/or model number other than the one named is procured, the Contractor shall be responsible for all changes necessary including additional design services incurred by the Owner to allow the installation of the selected product. It shall be the Owner's sole discretion to determine if additional design assistance is needed. Owner shall be compensated by the Contractor for the cost of the additional service to the Architect and/or Engineer to change the design and/or review the equipment placement changes elected to be made by the Contractor.

1.7 REFERENCE CODES AND STANDARDS

A. Requirements set forth in reference codes and standards are minimum for equipment, material and work. In instances where capacities, size, etc., of equipment, devices or materials listed in the Contract Documents exceed these minimums, listed or shown capacities, etc. shall prevail.

B. Comply with applicable laws, ordinances, codes and rules, with latest revisions adopted, of the following governing codes and agencies:

1. International Mechanical Code
2. Building Code of the City of Upper Sandusky
3. Fire Marshal of the State of Ohio
4. Ohio Plumbing Code, 2007 Edition
5. International Energy Conservation Code 2006

C. Industry standards and specifications issued by the following organizations shall apply to materials and workmanship:

1. AMCA Air Moving and Conditioning Association
2. ASME American Society of Mechanical Engineers
3. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
4. ETL Engineering Testing Laboratory
5. NEMA National Electrical Manufacturers' Association
6. NFPA National Fire Protection Association
7. SMACNA Sheet Metal and Air Conditioning Contractors' National Association
8. UL Underwriters' Laboratories, Inc.

D. Local laws and codes take precedence over state laws and codes, which, in turn, take precedence over national codes and industry standards.

E. Comply with the rules and regulations of the "Safety Code for Mechanical Refrigeration", (ANSI/ASHRAE 15-2007). Meet the requirements of the ASME Unfired Pressure Vessel Code. All pressure vessels shall be stamped "ASME" and "National Board". Furnish to the Owner for each pressure vessel supplied under this Specification, a manufacturer's data report for unfired pressure vessels, Form U-I, as required by the ASME Code Rules.

F. This form must be signed by a qualified inspector holding a National Board Commission, certifying that construction conforms to the latest ASME Code for Unfired Pressure Vessels. The ASME symbol "U" also shall be stamped on each vessel.

1.8 PERMITS AND INSPECTIONS

A. Permits and Fees: Obtain and pay for all permits. Pay fees and all other payments required by utility regulatory bodies in connection with the Work. Pay for all inspections required under local codes with regard to the Work.

B. Certificates of Inspection: Upon completion of the work, furnish certificates of inspection from all inspection or regulatory agencies having jurisdiction over work of Division 23.

1.9 EQUIPMENT AND MATERIALS

A. Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. The plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

B. The label of the approving agency, such as UL, AGA, ASME, ARI, AMCA, by which a standard has been established for the particular item, shall be in full view.

C. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be the manufacturer's latest design.

D. Deliver equipment and materials to the site and store in original containers, suitably sheltered from physical damage and the elements, but readily accessible for inspection. Equipment damaged in shipment will not be acceptable.

1.10 EXAMINATION OF PREMISES

A. Visit the site of the proposed work before bidding. Inspect the site and become familiar with the difficulties and restrictions attending the execution of the contract.

B. No additional compensation will be allowed for failure to be informed of site conditions.

1.11 SUBMITTALS:

A. General:

1. Submit for review shop drawings, product data and samples. Comply with requirements of Division 1 Section "Submittals". Minimum number of copies shall be four (4). Mark each

individual item with pertinent specification section and paragraph number. Submittal will be rejected if specification and paragraph number under which it is being submitted is not identified.

2. If the submittal deviates from the requirements of the Contract Documents, the deviation shall be identified in writing on the first page of the submittal. Identify where within the Contract Documents the deviation occurs. The deviation shall only be considered acceptable if the identified deviation has been initialed by the Engineer. Any deviation not initialed may be assumed to be rejected. All coordination required due to the deviation, such as space allocation, changes to electrical service, or any other required changes shall be born as Work of Division 23 but accomplished by Installers skilled in the Work being performed. No costs incurred by the approved deviation shall be born by the Owner.

3. Review of shop drawings and submittals does not relieve the Contractor of responsibility for compliance with the specific requirements of the Contract Documents, or for fitting the equipment in the space allotted, with proper space for connection of piping or ductwork and for servicing or for coordination of the work with work of other trades. Approval of deviations also does not relieve the Contractor of responsibility for compliance with all other aspects of the Contract Documents.

4. Review is for general conformance with the design concept of the project and general compliance with the information given in the project documents. Responsibility for confirming and correlating all quantities and dimensions, selecting fabrication processes and establishing techniques of construction resides with Contractor. Review subcontractors' submittals and shop drawings and indicate by rubber stamp or letter that they have been reviewed and approved before forwarding them. Submittals and Drawings will be returned after review indicating whether or not exceptions are taken and the required procedure to be followed thereafter. Revised and acceptable submittals and shop drawings are required before construction is begun. Include dimensional data and weights of equipment. Include motor manufacturers' names.

5. In general, the Architect and/or his consultants will review each submittal as indicated above. If submittal does not comply with the Contract Documents as indicated by the submittal being marked "REJECTED" and "RESUBMIT", be responsible to the Owner for any additional costs the Owner incurs due to review of follow-on submittals.

B. Samples:

1. Submission of samples may be required by the Architect, particularly where equipment is visible in finished areas. Arrange demonstrations of a product's ability to perform as specified if required. Include dimensional data and weights of equipment. Include motor manufacturers' names.

C. Shop Drawings:

1. Shop drawings shall consist of plans, sections, elevations and details to scale (no smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other Divisions and shall show space allotted for it. Include construction details and materials. As a minimum, submit shop drawings covering equipment

rooms, equipment foundations, equipment supports, ductwork, field-fabricated equipment, piping or any other drawings specifically called for in this and other Sections. Include the following:

a. Controls and instrumentation, including complete electrical interlock.
b. Built-up equipment.
c. Equipment rooms (any room in which there is Division 23 equipment)
d. Equipment housekeeping pads, and vibration isolation.
e. Field-fabricated hangers, supports, guides and anchors.
f. Piping & Ductwork Layouts.

D. The drawings show existing construction components and systems as on record by the Owner. As part of the shop drawing process, field verifies location and size of structural members, location of partitions, and existing systems shown. If field measurements differ from the information on the drawings which causes a conflict in the Work, promptly consult the Architect for resolution. The Owner shall not be responsible for any delays in construction due to the Contractor failing to field verify information shown on the drawings as existing.

E. Product Data:

1. Submit product data within 45 days after award of the Contract and before any equipment or materials are purchased. Product data is defined as manufacturers' printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp "No exception taken" on submittal is required before ordering equipment unless otherwise noted.

2. Submit items identified in the individual Sections. If product data have not been received within 45 days after award of the Contract, only the manufacturer named shall be allowed e.g. if "American Standard or approved equal" is stated in the Contract Documents, after 45 days only the American Standard product shall be allowed, or if the scheduled equipment on the drawings indicates "Loren-Cook" for fans, after 45 days only Loren-Cook products shall be allowed.

1.12 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 Section "Project Coordination" and as follows. Drawings shall be to a minimum scale of 1/4" = 1'-0" detailing major elements, components, and systems of mechanical equipment and materials in relationship with other building systems, installations, and components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work.

B. Indicate the proposed locations of piping, ductwork, equipment, and materials and include vertical measurement from floor to bottom of piping, ductwork, and elevated equipment. Piping drawings shall include access panel locations, valves, sleeves, location of supports, etc. Ductwork drawings shall include access panel locations (in duct and building construction to obtain entry to service and maintain duct mounted equipment), vanes, scoops, splitters, dampers, grilles, diffusers, coils, etc. Vertical measurement shall be indicated at all changes in direction of piping and ductwork. Measurement shall be made to the outside surface of exterior insulated ducting and

piping. Measurements shall include clearances for installing and maintaining insulation; servicing and maintaining equipment; space for equipment disassembly for periodic maintenance; and showing areas for tube, filter, and coil removal. Provide details of connections and supports, exterior wall and foundation penetrations, sizes and locations of concrete housekeeping pads, and indicate space for valve stem movement. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations. Include location of sleeves in floors, walls, and ceilings. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication system components, sprinklers, smoke detectors, and other ceiling mounted items.

D. Provide digital copies of final coordination drawings, separated by trade, to the owner in dwg and/or pdf file formats.

E. Mechanical ductwork priority over all other systems being installed (MEP) above ceiling. Rerouting of installed systems due to uncoordinated drawings is the responsibility of the general contractor.

1.13 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "Project Closeout". As a minimum, record documents shall show ductwork; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair; piping systems with valves and control devices located and numbered according to tags; concealed unions and items requiring maintenance such as traps, strainers, expansion compensators, expansion and compression tanks. Locate all access panels installed to maintain mechanical equipment. Reference prominent building lines when showing dimensions of equipment, pipe, ducting, and access panels. Identify installations different from the original plans due to product substitutions, Contract Modifications, and actual equipment and material installed. All elements underground shall be shown giving actual inverts and horizontal locations. Engage the services of a Land Surveyor or Professional Engineer registered in the State in which the project is located to record locations and invert elevations of underground installations. Complete this survey work prior to the covering of the underground installation.

B. Provide digital copies of final record documents, separated by trade, to the owner in dwg and/or pdf file formats.

1.14 PROJECT CLOSEOUT

A. Mark and otherwise correct a set of reproducible drawings to reflect the final location of all work installed under Division 23, to serve as record documents, in accordance with Division 1 Section "Project Closeout". Locate cleanouts, valves, traps, manual and automatic dampers, fire and smoke dampers, control sensing elements in ducts, and other concealed items requiring adjustment or maintenance. Supplement with additional sketches on tracing paper for clarification, if necessary. Certify in writing that record drawings have been checked and are accurate. Submittal of these documents is a prerequisite for certification of substantial completion. Contractor may obtain a set of reproducible drawings from the Architect and shall pay for them.

B. Conform to other requirements included in Division 1 Section, "Project Closeout".

1.15 WARRANTY

A. Refer to applicable paragraph under GENERAL CONDITIONS. Warrant all materials and workmanship for a period of five years. Repair or replace promptly defects due to faulty materials, methods of installation or workmanship, with the least inconvenience and without expense to the Owner and at time designated by the Architect within the five-year period. Additional specific performance or extended time warranties called for in the individual sections under this Division must be provided.

B. The warranty period for mechanical work shall commence on the date certified by the architect or engineer that the contract is substantially complete in accordance with the plans and specifications, or upon beneficial use by the Owner, whichever occurs first. When beneficial use is for only a portion of the work, the warranty shall commence only on that portion of the work.

1.16 MEASUREMENTS

A. Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Study carefully the sizes and locations of structural members, wall and partition locations, attic spaces, ceiling furring, chase spaces and room dimensions and take actual measurements on the job. Locate ductwork, piping, equipment and accessories, with sufficient space for installing, insulating and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment, piping or ductwork can not be fitted, the Architect shall be consulted. All equipment, apparatus and materials must fit into the available, designated spaces, with proper clearances for maintenance, service and repair.

1.17 OPERATION PRIOR TO SUBSTANTIAL COMPLETION

A. Owner shall have the right to operate systems and equipment prior to substantial completion, as soon as tested and operational, provided all safety devices have been installed. Agreement between Owner and Contractor relative to time and hours of operation and responsibility for start up and shutdown is required. Do not permit operation which may damage equipment or cause damage to the building or to the work of other contractors. Air filters must be in place on air conditioning units and strainers must be in place in all piping systems prior to operation.

1.18 CONTRACTOR OPERATION PRIOR TO SUBSTANTIAL COMPLETION

A. Obtain written authorization from the Owner for Contractor's use of equipment. If equipment is allowed to be used during construction period, all start-up requirements for the equipment shall be adhered to prior to operation including start-up procedures, required equipment check-out by factory authorized representatives, required equipment inspection reports, and commissioning as required in the individual Sections. A copy of operating and maintenance manuals shall be kept on-site while equipment is in operation. These manuals shall be made available to Owner's maintenance crews if Contractor is off-site and equipment is still in operation. In addition, no sooner than seven days prior to Substantial Completion being granted, original equipment check-out by factory authorized representative, required equipment inspection reports, and

commissioning shall be completed a second time. Equipment or components found not in compliance with the Contract Documents shall be replaced without cost to the Owner. Submit by letter to the Owner the date in which each piece of equipment is put into operation.

B. Maintain duct cleanliness during air handling equipment use by installing minimum 30% filter material over all return and exhaust openings. If duct cleanliness is found by the Architect to be unacceptable, duct shall be cleaned with alcohol impregnated pad and pad changed as it loads with dirt. Provide additional access panels within the ductwork allowing cleaning to be completed. Added access panels required for this remedial cleaning shall be provided at no cost to the Owner.

1.19 ELECTRICAL WORK

A. General:

1. Electrical service shall be as indicated on the Drawings. All power wiring and all circuit breakers, starters, disconnect switches, pilot lights, hand-off-automatic (H-O-A) switches, pushbutton stations, except such items which are provided as part of "packaged" mechanical equipment or specifically noted herein, shall be furnished, set in operating position, and electrically connected as work of DIVISION 26, ELECTRICAL.

2. Should the Contractor desire to use equipment requiring larger motors or electrical characteristics differing from those shown, it is the responsibility of work requirements under Division 23 to inform other affected parties of the proposed changes to permit them to supply proper wiring, disconnects and starters. Additional costs incurred to work of other Divisions caused by such changes shall be borne as work of Division 23. Coordination to establish areas of possible change between Division 23 work and work of another Division shall occur prior to equipment delivery from the manufacturer.

B. Starters: Motor starters furnished with mechanical equipment covered by this section shall conform to the requirements of Division 26. Provide motor overload protection requirements for sizing overload protection device for motor starters furnished under Division 26.

C. Conduit and Wiring: As work of Division 23, all interlock conduit and wiring and control conduit and wiring shall be provided, and all control elements shall be set in position and connected. Electrical wiring for firestats or smoke detectors which interrupt line voltage power circuits to motors and for wall-mounted thermostats which interrupts line voltage power circuits to motors and interlock from smoke detectors for the shutdown of motors shall be work of Division 23. Provide control transformers and additional relays required for interface with the electrical system. Unless indicated otherwise, power wiring and conduit for all devices shall be work of Division 26.

1.20 PAINTING

A. Painting shall be done under Section 09900, except for touch-up of factory finishes on equipment located inside and outside. Obtain matched color coatings from the manufacturer and apply as directed. Prime coating of certain equipment is specified under individual equipment specification. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint in accordance with requirements of Section 09900.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 PROTECTION OF EQUIPMENT AND WORK

A. Continuously maintain adequate protection of stored materials and installed work. Tightly cover fixtures and equipment, with sheet polyethylene or waterproof tarpaulin as protection against dirt, rust and moisture. Provide heat to equipment being stored to prevent condensation. Do not store materials and equipment outside, directly on the ground, or in areas where it may be subject to physical injury from vehicular traffic or construction machinery. Ductwork, piping andequipment installed under this Division shall not be used by other trades as supports for scaffolds or personnel. Do not deliver controls or other delicate equipment to the job site unless they can be placed in protected areas. At work completion, clean equipment, fixtures, exposed ductwork and piping, including hangers and supports to the Architect's satisfaction.

3.2 ROUGH-IN

A. Verify the final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to equipment specifications in Divisions 2 through 28 for rough-in requirements.

3.3 MECHANICAL INSTALLATIONS

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment with other building components. Verify all dimensions by field measurements. Arrange for chases, slots, and openings in other building components during progress of construction to allow for mechanical installations. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence and coordinate installation of large pieces of equipment prior to closing in the building.

B. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

C. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect with a suggested resolution. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building components, where installed exposed. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components without requiring the removal of permanent construction or disabling the function of a required fire-resistance-rated assembly. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location external to the piece of equipment. Install access panel or doors

where equipment is concealed behind finished surfaces. See Division 8 Section "Access Doors" and Division 23 Section for related basic mechanical materials and methods.

E. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope. In general, ductwork shall take precedence over piping. Set system elevations to minimize offsets where systems cross. Make full use of all three dimensions and stack ductwork, equipment, and accessories vertically as required. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

3.4 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "Cutting and Patching". Engage experienced Installers in cutting and patching this work. Installers' qualifications refer to the materials and methods required for the surface and building components being patched. See Division 1 Section "Definitions and Standards" for definition of "experienced Installer". Protect adjacent installations during all cutting and patching operations.

B. Perform cutting, fitting, and patching for mechanical equipment and material installation. Uncover work to provide for installation of ill-timed work. Remove and replace defective mechanical work and work not conforming to requirements of the Contract Documents. Install equipment and materials in existing structures. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers.

C. Upon written instructions from the Architect, uncover and restore work to provide for Architect observation of concealed work covered prior to inspection. Uncovering and restoring work required to be observed by the Architect prior to covering as identified in the Contract Documents will be at no cost to the Owner.

D. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items as identified in the Contract Documents. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers.

END OF SECTION 23 01 00

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Summary: General requirements for motors, hangers and supports, vibration isolation, and meters and gages.

B. Submittals: Product Data for materials and equipment specified in this Section.

PART 2 - PRODUCTS

2.1 MOTORS

A. Motor Characteristics (verify with other trades prior to ordering):

1. Motors 3/4 HP and Larger: Three phase.
2. Motors Smaller Than 3/4 HP: Single phase.
3. Frequency Rating: 60 Hz.
4. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
5. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
6. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
7. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
8. Enclosure: Unless otherwise indicated, open dripproof.
9. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

2.2 HANGERS AND SUPPORTS

A. Hanger and Pipe Attachments: Factory fabricated with galvanized coatings; nonmetallic coated for hangers in direct contact with copper tubing.

B. Building Attachments: Powder-actuated-type, drive-pin attachments with pullout and shear capacities appropriate for supported loads and building materials.

C. Mechanical-Expansion Anchors: Insert wedge-type attachments with pullout and shear capacities appropriate for supported loads and building materials.

2.3 VIBRATION ISOLATION

A. Vibration Supports:

1. Pads: Arranged in single or multiple layers of oil- and water-resistant neoprene, rubber, or hermetically sealed compressed fiberglass of sufficient stiffness for uniform loading

over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

2. Mounts: Double-deflection type, with molded, oil-resistant fiberglass, rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and baseplate for bolting to structure. Provide isolator with minimum 0.5-inch static deflection.
3. Spring Isolators: Freestanding, laterally stable, restrained or open-spring isolators. Provide isolator with minimum 1-inch static deflection.

B. Vibration Hangers:

1. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Provide isolator with minimum 0.5-inch static deflection.
2. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression. Provide isolator with minimum 1-inch static deflection.

2.4 PRESSURE GAGES AND TEST PLUGS

A. Pressure Gages: Direct-mounting, indicating-dial type complying with ASME B40.100. Dry metal case, minimum 2-1/2-inch diameter with red pointer on white face, and plastic window. Minimum accuracy 3 percent of middle half of range. Range two times operating pressure.

B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating 500 psig at 200 deg F.

PART 3 - EXECUTION

3.1 MOTOR INSTALLATION

A. Anchor motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions.

3.2 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.

D. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.

E. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.

F. Install unions at final connection to each piece of equipment.

G. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.

H. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.3 GENERAL EQUIPMENT INSTALLATIONS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.4 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.

B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

C. Install powder-actuated drive-pin fasteners in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches thick.

D. Install mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches thick.

E. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.

F. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

3.5 VIBRATION ISOLATION

A. Adjust vibration isolators to allow free movement of equipment limited by restraints.

B. Install resilient bolt isolation washers and bushings on equipment anchor bolts.

C. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

END OF SECTION 23 05 00

SECTION 23 0517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. [Fire-resistance-rated, watertight] [Watertight]sleeve-seal systems.
4. Grout.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Cast-in-place watertight device for protecting penetrating objects from expansion and contraction of concrete. Factory-assembled for use in cast-in-place concrete floors and walls and consisting of two outer sleeves and a one-piece radial extended-flange waterstop gasket, with mid-body seal for embedment and sealing to concrete slab and continuous water seal extending to the penetrating pipe.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Presealed Systems, LLC; Hydro Preseal, or a comparable product.

2. Outer Sleeves: [EPDM] [NBR] <Insert other> attached to the mid-body seal forming an area with which to attach the device to the structural reinforcing rod determining the position of sleeve in the wall.
3. Water Stop Mid-body Seal: Flexible polymer seal with radial extended flange consisting of one to three concentric raised rings which lock into concrete, maintaining seal over time as concrete contracts from sleeve. <Describe size and type of pipe to be inserted in sleeve seal>.

E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] or comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

C. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: [EPDM-rubber] [NBR] interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: [Carbon steel] [Plastic] [Stainless steel].
3. Connecting Bolts and Nuts: [Carbon steel, with corrosion-resistant coating,] [Stainless steel] of length required to secure pressure plates to sealing elements.

2.3 [FIRE-RESISTANCE-RATED,]WATERTIGHT SLEEVE-SEAL SYSTEMS

A. Description: Cast-in-place, factory-assembled, one-piece watertight firestop device for use in concrete floors formed with wood decking to protect penetrating objects from expansion and contraction of concrete, thermal and seismic movement, and the passage of air, smoke, fire, and hot gasses.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Presealed Systems, LLC; Hydroflame Sleeve, or a comparable product.

2. Consists of an outer sleeve lined with an intumescent strip, and a radial extended flange attached to one end of the sleeve for fastening to concrete formwork.
3. Include a waterstop gasket and mid-body seal consisting of one to three concentric raised rings for embedment and sealing to the concrete slab.

4. Provide a two-hour fire-resistance rated assembly when tested according to ASTM E 814 or ANSI/UL 1479.

B. Description: Cast-in-place, factory-assembled, one-piece watertight firestop device for use in floors formed with steel decking to protect penetrating objects from expansion and contraction of concrete, thermal and seismic movement, and the passage of air, smoke, hot gasses and fire.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Presealed Systems, LLC; Hydroflame CMD Metal Deck Device, or a comparable product.

2. Consists of an outer sleeve lined with an intumescent strip, and wide outside wings attached to one end of the sleeve for fastening to metal deck concrete formwork and span deck corrugations.
3. Includes a cone attached to the base for extending the device through the metal deck and a waterstop gasket and mid-body seal consisting of one to three concentric raised rings for embedment and sealing to the concrete slab.

4. Provide a two-hour fire-resistance rated assembly when tested according to ASTM E 814 or ANSI/UL 1479.

C. Description: Cast-in-place, watertight tub box drain block out firestop device for use in floors formed with wood decking to protect penetrating objects from expansion and contraction of concrete, thermal and seismic movement, and the passage of air, smoke and fire, and hot gasses.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Presealed Systems, LLC; Hydroflame Tub Box, or a comparable product.

2. Consists of a reinforced polymer box containing a 2-1/2-inches (63.5 mm) thick polystyrene foam insert with an upper water seal consisting of absorbent material and a pitched water trough.
3. Include a sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork.
4. Include two support legs each with a radial extended flange for balance and for fastening to concrete formwork, and a lower water-seal and radial extended flange attached to the lower end of the sleeve for fastening to concrete formwork and a waterstop gasket with three concentric raised rings for embedment and sealing to the concrete slab.

5. Provide a two-hour fire-resistance rated assembly when tested according to ASTM E 814 or ANSI/UL 1479.

2.4 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide [1-inch (25-mm)] annular clear space between piping and concrete slabs and walls.

1. When cast-in-place watertight sleeve seals are required, select sleeve size to match the size and type of pipe to be installed.

2. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas [2 inches (50 mm)] above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
4. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."Exception: When fire-resistance-rated cast-in-place watertight sleeve seals are required for floor penetrations, additional firestopping is not necessary.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

C. Aboveground, Cast-in-Place Watertight Sleeves. Select sleeve size based on pipe size and material to be inserted, and thickness of wall.

1. Install cast-in-place watertight sleeves for pipes NPS 6 (DN 150) and smaller in diameter.
2. Position cast-in-place water tight sleeve in wall space securing sleeve to reinforcing steel using tie wire.

D. Underground, Exterior-Wall, Cast-in-Place Watertight Penetrations. Select sleeve size based on pipe size and material to be inserted, and thickness of wall.

1. Install cast-in-place watertight sleeves for pipes NPS 6 (DN 150) and smaller in diameter.
2. Secure sleeve to the reinforcing steel using tie wire.

E. Fire-Resistance Rated, Cast-in-Place Sleeve Installation: Select sleeve size based on size and type of pipe and thickness of the floor. Position and secure sleeve to concrete form using nails or staples. Place concrete, and finish even with top of sleeve.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use [sleeves and sleeve seals] [cast-in-place watertight sleeve seals] [fire-resistance-rated cast-in-place watertight sleeve seals] for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping [NPS 6 (DN 150)] <Insert pipe size> and Smaller: Presealed Systems LLC; Hydropreseal.

b. Piping Smaller Than [NPS 6 (DN 150)] <Insert pipe size>: [Cast-iron wall sleeves] [Galvanized-steel wall sleeves] [Galvanized-steel-pipe sleeves] <Insert material>.
c. Piping [NPS 6 (DN 150)] <Insert pipe size> and Larger: [Cast-iron wall sleeves] [Galvanized-steel wall sleeves] [Galvanized-steel-pipe sleeves] <Insert material>.

2. Exterior Concrete Walls below Grade:

a. Piping [NPS 6 (DN 150)] <Insert pipe size> and Smaller: Presealed Systems LLC; Hydropreseal.

b. Piping Smaller Than [NPS 6 (DN 150)] <Insert pipe size>: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] <Insert material>.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

c. Piping [NPS 6 (DN 150)] <Insert pipe size> and Larger: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] <Insert material>.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping [NPS 6 (DN 150)] <Insert pipe size> and Smaller: Presealed Systems LLC; Hydropreseal.

b. Piping Smaller Than [NPS 6 (DN 150)] <Insert pipe size>: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] <Insert material>.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

c. Piping [NPS 6 (DN 150)] <Insert pipe size> and Larger: [Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves with sleeve-seal system] [Galvanized-steel-pipe sleeves] <Insert material>.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping [NPS 6 (DN 150)] <Insert pipe size> and Smaller: Presealed Systems LLC; [Hydroflame Cast-in-Place Sleeve] [Hydroflame Tub Box].

b. Piping Smaller Than [NPS 6 (DN 150)] <Insert pipe size>: [Galvanized-steel-pipe sleeves] [PVC-pipe sleeves] <Insert material>.

c. Piping [NPS 6 (DN 150)] <Insert pipe size> and Larger: [Galvanized-steel-pipe sleeves] [PVC-pipe sleeves] <Insert material>.

5. Interior Partitions:

a. Piping Smaller Than [NPS 6 (DN 150)] <Insert pipe size>: [Galvanized-steel-pipe sleeves] [PVC-pipe sleeves] <Insert material>.

b. Piping [NPS 6 (DN 150)] <Insert pipe size> and Larger: [Galvanized-steel-sheet sleeves] <Insert material>.

END OF SECTION 23 0517

SECTION 23 0523 - GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following Valves:

1. Gate valves.
2. Ball valves.
3. Plug valves.
4. Butterfly valves
5. Swing check valves.
6. Wafer check valves.
7. Lift check valves.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design this project element, including comprehensive engineering analysis by a qualified design professional, to meet or exceed the program requirements, performance requirements, code compliance, applicable ASTM quality standard, and design criteria as outlined and / or referenced within this RFP package.

1.4 SUBMITTALS

A. Not used.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

2.2 VALVES

A. General duty valves in cast iron, bronze and brass, fabricated to comply with Manufacturer's Standardization Society (MSS) classification listed. Gate, globe, ball, butterfly and plug valves for shutoff duty; globe, ball and plug valves for throtlling duty.

1. Gate valves, 2-inch and smaller, for Chilled Water, Domestic Hot and Cold Water service: MSS SP-80, Class 125 or Class 150, cast bronze, threaded or soldered ends, based upon service requirements.
2. Gate valves, 2-inch and smaller, for Heating Hot Water, Steam service: MSS SP-80, Class 150, cast bronze, threaded or soldered ends, based upon service requirements.
3. Gate valves, 2 1/2-inch and larger: MSS SP-70, Class 125, iron body, flanged ends.
4. Ball valves, 1-inch and smaller: Rated for 150 psi saturated steam service, 400 psi water-oil-gas (WOG) service, 2-piece construction, bronze body, threaded or soldered ends, based upon service requirements.
5. Ball valves, 1 1/4-inch to 2-inch: Rated for 150 psi saturated steam service, 400 psi WOG, 3-piece construction, bronze body, threaded or soldered ends, based upon service requirements.
6. Plug valves, 2-inch and smaller: Rated at 150 psi WOG, bronze body, threaded ends.
7. Plug valves, 2 1/2-inch and larger: MSS SP-78, rated at 175 psi WOG, semi-steel body, flanged ends.
8. Globe valves, 2-inch and smaller: MSS SP-80, Class 125 or Class 150, cast bronze.
9. Globe valves, 2 1/2-inch and larger: MSS SP-85, Class 125, iron body.
10. Butterfly valves, 2 1/2-inch and larger: MSS SP-67, rated at 200 psi, cast iron body, field replaceable sleeve, stainless steel stem, lug or wafer type, based upon service requirements.
11. Swing check valves, 2-inch and smaller: MSS SP-80, Class 125 or Class 150, cast iron body and cap, threaded or soldered ends, based upon service requirements.
12. Swing check valves, 2 1/2-inch and larger: MSS SP-71, Class 125, cast iron body and cap, flanged ends.
13. Wafer check valves: Class 250, cast iron body, to open with one foot differential pressure.
14. Lift check valves, 2-inch and smaller: Class 125, cast bronze body and cap, threaded ends.
15. Gate valves, 2-inch and smaller: Used for general shutoff application on all High Temperature Hot Water systems shall be Class 600 psi, ASTM A-216-WCB steel body and bonnet, with 600 psi socket weld ends, solid disc, copper-silicon alloy stem, brass packing gland, Teflon(r) impregnated packing, and malleable iron handwheel. Provide Class 600 psi valves meeting the above specifications where system operating pressure and test pressures allow.
16. Gate valves, 65-mm and larger: Used for shutoff application on all High Temperature Hot Water systems shall be Class 600, ASTM A-216-WCB steel body, mounted, with body and bonnet conforming to ASTM A-216-WCB with flanged ends, Teflon(r) impregnated packing and two piece backing gland assembly, with mose ends, flex

wedge, inside screw, rising stem and provided cap and chain. Grease fittings shall be supplied for shaft packing.

17. Ball valves, 1-inch and smaller: Class 600 psi, two piece construction, with steel body conforming to ASTM B62, conventional port, chrome plated brass ball , replaceable Teflon(r) or TFE seats and seals, blowout-proof stem and vinyl covered steel handle. Provide solder ends for hot water service. Provide socket weld ends on medium and high pressure steam and condensate service valves.
18. Ball valves, for hot water service, to 6-inches: Class 600 psi, three piece construction, with steel body conforming to ASTM B62, conventional port, chrome plated brass ball , replaceable Teflon(r) or TFE seats and seals, blowout-proof stem and vinyl covered steel handle. Provide socket weld ends for high temperature hot water service. Ball seats and stem must be easily replaced without removing valve pipe connections from line. Leakproof at all pressures up to 600 psi. Construction of valve shall allow for actuator, if needed. Valve stem shall be blowout proof.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner to engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in compliance with CO-7 DB section 16.

END OF SECTION 23 0523

SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes hangers and supports for mechanical systems piping and equipment.

1.3 DEFINITIONS

A. Terminology used in this Section is defined in MSS SP-90.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of hanger and support.

C. Submit pipe hanger and support schedule showing manufacturer's Figure No., size, location, and features for each required pipe hanger and support.

D. Shop drawings for each type of hanger and support, indicating dimensions, weights, required clearances, and methods of component assembly.

1.5 QUALITY ASSURANCE

A. Qualify welding processes and welding operators according to AWS D1.1 "Structural Welding Code--Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. NFPA Compliance: Comply with NFPA 13 for hangers and supports used as components of fire protection systems.

C. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70, Article 100.

1. UL and FM Compliance: Hangers, supports, and components include listing and labeling by UL and FM where used for fire protection piping systems.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Hangers, Supports, and Components: Factory-fabricated according to MSS SP-58.

1. Components include galvanized coatings where installed for piping and equipment that will not have a field-applied finish.
2. Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) average compressive strength, waterproofed calcium silicate, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.

C. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

2.2 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36 (ASTM A 36M), steel plates, shapes, and bars, black and galvanized.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Grout: ASTM C 1107, Grade B, nonshrink, nonmetallic.

1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic-cement-type grout that is nonstaining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Water: Potable.
4. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in the Section specifying the equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping specification Sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. General: Comply with MSS SP-69 and SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible.

C. Install supports with maximum spacings complying with MSS SP-69.

D. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

E. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Install reinforcing bars through openings at top of inserts.

F. Install concrete inserts in new construction prior to placing concrete.

G. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (100 mm) thick.

H. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (100 mm) thick.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Heavy-Duty Steel Trapezes: Field-fabricate from ASTM A 36 steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

K. Support fire protection systems piping independent of other piping.

L. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.

O. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

3. Shields: Install MSS Type 40, protective shields on cold piping with vapor barrier. Shields span an arc of 180 degrees (3.1 rad) and have dimensions in inches (mm) not less than the following:

4. Pipes 8 Inches (DN 200) and Larger: Include wood inserts.
5. Insert Material: Length at least as long as the protective shield.
6. Thermal-Hanger Shields: Install with insulation of same thickness as piping.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make a smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint and paint exposed areas immediately after erection of hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal is specified in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 0529

SECTION 23 0548 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Contract Provisions, Special Provisions, Division 00 Supplementary Conditions, and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Elastomeric hangers.
4. Pipe riser resilient supports.

1.3 DEFINITIONS

A. IBC: 2003 International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure and spring deflection changes. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to the COTR.

B. Comply with seismic-restraint requirements in the VUSBC 2003 unless requirements in this Section are more stringent.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

C. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

Verify availability of various pad materials with manufacturers.

1. Resilient Material: Oil- and water-resistant neoprene rubber.

D. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.

2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION-CONTROL DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Sheet Metal Roofing Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

3.3 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.4 HVAC VIBRATION-CONTROL DEVICE SCHEDULE

A. Supported or Suspended Equipment:

1. Garage A: Basement Mechanical Room - Chilled Water Pumps: 1" thick neoprene pads.
2. Provide neoprene vibration isolation pipe hangers within 10 feet of each pump.
3. Chilled water pipe riser isolation - 1" thick neoprene pads.
4. Garage B/C: 1" thick neoprene pads for Unit No. 1 serving elevator machine room, condensing units on roof, and roof mounted heat pump a/c unit on vibration isolation mounts.

B. B/C Garage Tower Roof:

1. Neoprene pads 1" thick for each condensing unit.

PART 4 - FIELD QUALITY CONTROL

A. Conform to all applicable provisions of Division 01 section, "Quality Requirements."

B. The following describes the minimum inspection and testing required in the Contractor's Quality Control (CQC) Plan and Program for the work of this section and is for CQC only. The implementation of the Contractor Quality Control Program does not relieve the Contractor from the responsibility to provide the work in accordance with the Contract Documents, applicable codes, regulations and governing authorities. The CQC plan and program shall include, but not be limited to, the testing and inspection elements specified herein and in all applicable Division 00 and Division 01 specifications. These elements are provided only as a minimum starting point for the contractor to use to generate his complete CQC Program. The contractor shall engage an independent testing agency to perform specified sampling, testing, and inspections, meeting all requirements specified herein.

END OF SECTION 23 0548

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

Part 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identifying Devices and Labels

B. Related Sections:

1. Section 23 05 00 (15050) - Common Work Results for HVAC

1.2 SUBMITTALS

A. Submit "Letter of Conformance" in accordance with section 01 33 00 (01330) indicating specified items selected for use in Project with the following supporting data:

1. Product Data: For identification materials and devices.
2. Samples: Of color, lettering style, and graphic representation required for each identification material and device.

1.3 QUALITY ASSURANCE

A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.4 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

Part 2 - PRODUCTS

2.1 GENERAL

A. General: Products specified are for applications referenced in other Division 23 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Pipes Including Insulation: Full-band pipe markers, extending 360 degrees around pipe at each location.

2.2 IDENTIFYING DEVICES AND LABELS

A. Lettering: Manufacturer's standard preprinted captions as selected by Owner's Representative.

B. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

C. Plastic Duct Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cold-air supply.
2. Yellow: Hot-air supply.
3. Blue: Exhaust, outside, return, and mixed air.
4. Terminology: Include direction of airflow; duct service such as supply, return, and exhaust; duct origin, duct destination, and design flow.

D. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

E. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch thick, polished brass.
2. Size: 1-1/2-inches diameter, unless otherwise indicated.

F. Valve Tag Fasteners: Brass, wire-link chain and S-hooks.

G. Access Panel Markers: 1/16-inch thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch center hole for attachment.

H. Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include screws.

1. Frame: Extruded aluminum.
2. Glazing: ASTM C1036, Type I, Class 1, Glazing quality B, 2.5-mm, single-thickness glass.

I. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

Part 3 - EXECUTION

3.1 LABELING AND IDENTIFYING PIPING SYSTEMS

A. Install pipe markers on each system as indicated below. Include arrows showing normal direction of flow.

1. Gas.
2. Condensate.
3. Vent.
4. Chilled Water Supply
5. Chilled Water Return
6. Heating Hot Water Supply
7. Heating Hot Water Return
8. Condenser Water Supply
9. Condenser Water Return

B. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, noninsulated pipes.

C. Fasten markers on pipes and insulated pipes by one of following methods:

1. Snap-on application of pretensioned, semirigid plastic pipe marker.

D. Locate pipe markers where piping is exposed in machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations according to the following:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
3. Near penetrations through walls, floors, ceilings, or nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at a maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.2 VALVE TAGS

A. Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.

B. Valve Tag Application Schedule: Tag valves according to size, shape, color scheme, and with captions similar to those indicated in the following:

1. Chilled Water
2. Heating Hot Water
3. Condenser Water

C. Tag Material: Brass.

D. Tag Size and Shape: According to the following:

1. Cold Water: 1-1/2 inches round.
2. Hot Water: 1-1/2 inches round.
3. Gas: 1-1/2 inches round.

E. Install framed valve schedule in each major mechanical equipment room.

F. Valve schedule and tag locations shall be shown on record drawings.

3.3 LABELING AND IDENTIFYING DUCT SYSTEMS.

A. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.

1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 ADJUSTING AND CLEANING

A. Relocate HVAC identification materials and devices that have become visually blocked by work of this or other Divisions.

B. Clean faces of identification devices and glass frames of valve charts

END OF SECTION 22 0553

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. This Section includes testing and balancing to produce design objectives for air systems.

B. Certified Reports: Submit three copies of reports prepared, as specified in this Section, on approved forms certified by test and balance firm.

C. TAB Firm Qualifications: Engage a TAB firm certified by NEBB or AABC.

D. TAB Report Forms: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper test and balance of systems and equipment.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

D. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

E. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

F. Examine HVAC equipment to ensure that clean filters have been installed, belts are aligned and tight, and equipment with functioning controls is ready for operation.

G. Examine automatic temperature system components to verify the following:

1. Integrity of dampers and valves for free and full operation and for tightness of fully closed and fully open positions.
2. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
3. Sensors are located to sense only the intended conditions.

4. Controller set points are set at indicated values.
5. Interlocked systems are operating.
6. Changeover from heating to cooling mode occurs according to indicated values.

H. Report deficiencies discovered before and during performance of test and balance procedures.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

E. After testing and adjustments procedures have been completed, a system checkout shall be performed with the balancer present. A representative of RAC shall be given 48 hours notice that the system is ready for final checkout and inspection. Any defects found in the work shall be corrected.

F. Automatic temperature control systems shall be adjusted, tested and in operation to assure satisfactory operation.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare schematic diagrams of systems' "as-built" duct layouts.

B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

C. Verify that motor starters are equipped with properly sized thermal protection.

D. Check for airflow blockages.

E. Check condensate drains for proper connections and functioning.

F. Check for proper sealing of air-handling unit components.

G. Check for proper sealing of air duct system.

H. Adjust pulleys, and sheaves as required.

3.4 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 5 percent.

END OF SECTION 20 0593

SECTION 23 0700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:

1. Piping System Insulation:
   a. Fiberglass
   b. Cellular Glass.
   c. Flexible Unicellular.
   d. Flexible Unicellular (exterior application shall include UV protection and Aluminum jacket with weather-proof construction.

2. Ductwork System Insulation:
   a. Fiberglass.
   b. Flexible Unicellular.

3. Equipment Insulation:
   a. Fiberglass.
   b. Flexible Unicellular.

C. Related Sections: The following Sections contain requirements that relate to this Section.

1. Division 23 section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.
2. Division 23 section "Metal Ducts" for duct linings; not work of this section.
3. Division 23 section "Mechanical Identification" for installation of identification devices for piping, ductwork, and equipment; not work of this section.

1.2 SUBMITTALS

A. Refer to Section Division 23 "Basic Mechanical Requirements."

B. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

1.3 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least five (5) years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastic and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 23 Section "Basic Mechanical Requirements."

B. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

C. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. ArmaCell.
2. CertainTeed Manson.
3. Knauf Fiber Glass GmbH.
4. Johns Manville.
5. Owens-Corning Fiberglass Corp.
6. Pittsburgh Corning Corp.
7. Rubatex Corp.
8. Reflectix.

2.2 PIPING INSULATION MATERIALS

A. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated.

B. Cellular Glass Piping Insulation: ASTM C 552, Type II, Class 2.

C. Flexible Unicellular Piping Insulation: ASTM C 534, Type I.

D. Jackets for Piping Insulation: ASTM C 1136, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.

1. Encase fiberglass pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
2. Encase all exposed pipe insulation in occupied rooms with PVC pipe covers.

a. Thickness shall be 30 mil from floor level to 9 feet above finished floor. Otherwise, thickness shall be 20 mil.
b. Bond all PVC seams in occupied rooms with polyco VP adhesive, or equal. Bond adhesive shall conform to ASTM D-2654.

E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

G. Removable/Reusable Insulation Valve Covers: Two piece, silicone impregnated finish, Type E glass fiber insulation. Multiglas Products Co., MULTI COV-R, or approved equal.

2.3 DUCTWORK INSULATION MATERIALS

A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class 1, 6 LBS/FT3.

B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, Class B-4, 1.5 LBS/FT3.

C. Fire rated ductwork insulation. Unifrax Firewrap or approved equal. Blanket shall be manufactured from calcia, magnesia, silica chemistry designed to enhance biosolubility, 8 lb/cubic feet, ASTM E84 with flame spread less than 25 and smoke developed rating less than 50.

1. Fire rated insulation installation materials: Sodium silicate glue, 1/2" steel bands.

D. Jackets for Ductwork Insulation: Foil-Skrim-Kraft (FSK) ASTM C 1136, Type I for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient.

E. Ductwork Insulation Accessories: Provide staples, bands, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

F. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

2.4 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Equipment Insulation: ASTM C 612, Class 2, 6 LBS/FT3.

B. Flexible Fiberglass Equipment Insulation: ASTM C 553, Type II, Class F-1,4.5 LBS/FT3.

C. Flexible Unicellular Equipment Insulation: ASTM C 534, Type II.

D. Jacketing Material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or aluminum jacket at Installer's option, except as otherwise indicated.

E. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastic and protective finishes as recommended by insulation manufacturer for applications indicated.

F. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 HVAC PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on unions, flexible connections, and expansion joints.

B. Cold Piping (below 40 deg. F) Application Requirements: Insulate the following sub-freezing HVAC piping systems:

1. Refrigerant suction lines between evaporators and compressors.
2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1 inch thick for pipe sizes up to and including 1 inch, 1-1/2 inch thick for pipe sizes over 1 inch.
b. Flexible Unicellular: 1 inch thick for pipe sizes up to and including 1 inch (largest size permitted).

C. Cold Piping (40 degree F to 60 degree F) Application Requirements: Insulate the following cold HVAC piping systems:

1. HVAC chilled water supply and return piping.
2. HVAC dual temperature water supply and return piping.
3. HVAC make-up water piping.
4. Air conditioner condensate drain piping.
5. Chemical feed piping.
6. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1 inch thick for pipe sizes up to 1 inch, 1-1/2 inch thick for pipe sizes 1-1/4 inch and larger.

D. Hot Piping (to 200 deg. F) Application Requirements: Insulate the following HVAC piping systems:

1. HVAC hot water supply and return piping.
2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1 inch thick for pipe sizes up to 1 inch, 1-1/2 inch for pipe sizes 1-1/4 inch up to and include 4 inch, 2 inch thick for pipes 5 inch and larger.

3.3 DUCTWORK SYSTEM INSULATION

A. Insulation Omitted: Do not insulate the following ductwork:

1. Fibrous glass ductwork.
2. Lined ductwork.
3. Exposed ductwork installed within conditioned spaces (excluding mechanical rooms).

B. Ductwork Application Requirements: Insulate the following ductwork:

1. Outdoor exposed duct flanges-single wall and double wall. Provide rigid insulation on all exposed flanges prior to covering with Alumagard wrap.
2. Outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet.
3. HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet.
4. HVAC return ductwork in mechanical equipment rooms or installed outdoors.
5. HVAC plenums and unit housings not pre-insulated at factory or lined.
6. Exhaust fan and gravity relief plenums and ductwork 10 feet in all directions below roof. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:

a. Rigid Fiberglass: 2 inch thick, for indoor exposed ductwork; 3” thick for exterior ductwork.
b. Flexible Fiberglass: 2 inch thick, application limited to indoor concealed locations.

C. Ductwork penetrating 2-hour fire separation; provide fire rated insulation where indicated and as required to maintain fire rating integrity.

D. All exposed ductwork, insulated or uninsulated, shall be covered per section 3.8.

3.4 EQUIPMENT INSULATION

A. Cold Equipment (Below Ambient Temperature) Application Requirements: Insulate the following cold equipment:

1. Refrigeration equipment, including chillers, tanks and pumps.
2. Drip pans under chilled equipment.
3. Cold and chilled water pumps.
4. Air separators.
5. Expansion tanks
6. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1 inch thick for surfaces above 40 deg. F (2 deg. C) and 1-1/2 inch thick for surfaces 40 deg. F (2 deg. C) and lower.
b. Flexible Unicellular: 1-1/2 inch thick.

B. Hot Equipment (Above Ambient Temperature) Application Requirements: Insulate the following hot equipment:

1. Air separators.
2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:

   a. Fiberglass: 2 inch thick.

3.5 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings, air separators and all other piping system components in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 inch wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

I. Provide removable valve covers for valves which must be accessed periodically.

3.6 INSTALLATION OF DUCTWORK INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

G. Corner Angles: Install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

H. Fire rated duct insulation: Wrap blanket around duct and provide 1/4 inch bands at 12 inch centers. Completely install per manufacturer’s instructions to obtain 2-hour fire resistance rating.

3.7 INSTALLATION OF EQUIPMENT INSULATION

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to equipment, breechings, or stacks while hot.

E. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

F. Coat insulated surfaces with layer of insulating cement, trawled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2 inch. Apply over vapor barrier where applicable.

H. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames, accessories and pumps.

3.8 OUTDOOR INSULATION FINISH

A. General: Piping, ductwork and equipment exposed to weather shall have insulation protective finish or jacketing installed as recommended by manufacturer.

B. Piping: Shall have a 0.020 inch minimum thickness PVC jacket with moisture barrier with locking longitudinal seam and butt straps. Fittings, valves, flanges, etc., shall have factory or job fabricated PVC cover secured with banking and/or screws.

C. Round ductwork: Same finish as piping.

D. Rectangular Ductwork and Equipment: Shall have a laminated jacketed system Alumaguard 60 by Polyguard Products, Inc., or approved equal. The laminated jacketing system shall be 60 mil thick, and shall consist of a rubberized bitumen compound, heat applied to a cross-laminated high strength polyethylene film, laminated to aluminum foil.

3.9 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 23 0700

SECTION 23 0713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resin-bonded fiber glass duct insulation.

1.2 REFERENCES

A. ASTM International:

1. ASTM C411 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
2. ASTM C1104/C1104M Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
5. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. National Fire Protection Association (NFPA):

1. NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. North American Insulation Manufacturers Association (NAIMA):

1. AH100 Fibrous Glass HVAC Duct Systems: Proven Performance.

D. Underwriters Laboratories, Inc. (UL):

1. UL 181 Factory-Made Air Ducts and Air Connectors.
2. UL 723 Test for Surface Burning Characteristics of Building Materials.

E. Underwriters' Laboratories of Canada (ULC):

1. CAN/ULC-S102-M Test for Surface Burning Characteristics of Building Materials.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Stiffness: Specified value (product of Young's modulus of elasticity and moment of inertia) when tested in accordance with NAIMA AH100.
2. Service Temperature (ASTM C411): Up to 250 degrees F (121 degrees C).
3. Maximum Air Velocity (UL 181): 5000 feet per minute (1524 mpm).

4. Maximum Internal Static Pressure (UL 181): Plus or minus 2 inches (51 mm) of water or 498 Pa.
5. Water Vapor Transmission (ASTM E96): Less than 0.02 perms.
6. Water Vapor Absorption (ASTM C1104): Less than 3 percent by weight.
7. Microbial Growth (ASTM G21 and UL 181): Does not promote or support the growth of mold, fungi or bacteria.
8. Surface Burning Characteristics of FSK-Faced Insulation (ASTM E84, CAN/ULC-S102-M, NFPA 255 and UL 723):

    a. Flamespread: 25, maximum.
    b. Smoke Developed: 50, maximum.

1.4 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's SPEC-DATA sheet, for specified products.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements and Approvals: [Specify applicable requirements of regulatory agencies.].

1. [Code agency name].

    a. [Report or approval number].

B. Qualifications:

1. Manufacturer Qualifications: Minimum of 10 years experience in manufacturing building insulation products.

1.6 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01 Product Requirements Section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Handling: Handle materials to prevent bending, warping, twisting and surface damage.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 DUCT INSULATION

A. Manufacturer: Knauf Insulation.

1. Contact: One Knauf Dr., Shelbyville, IN 46176; Telephone: (800) 825-4434, (317) 398-4434; Fax: (317) 398-3675; website: www.KnaufInsulation.us.

B. Substitutions: No substitutions permitted.

2.2 MATERIALS

A. Eclipse Air Duct Board:

1. Thickness: [1 inch (25.4 mm)] [1.5 inches (38 mm)] [2 inches (51 mm)].
2. Size: [48 inches wide x 96 inches long (1219 x 2438 mm)] [48 inches wide x 120 inches long (1219 x 3048 mm)].
3. Edge: [Butt] [Shiplap].
4. Stiffness: [EI-475] [EI-800].

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Fit insulation to form a complete, tight-fitting thermal barrier around required areas.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair or replace damaged products prior to Substantial Completion.

END OF SECTION 20 0713

SECTION 23 2300 – REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Comply with ASME B31.5, "Refrigerant Piping," and with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

PART 2 - PRODUCTS

2.1 TUBES AND FITTINGS

A. Copper Tube: ASTM B 88, Types K and L and ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

D. Brazing Filler Metals: AWS A5.8.

2.2 VALVES

A. Thermostatic Expansion Valve: Comply with ARI 750; forged brass or steel body, stainless-steel internal parts, copper tubing filled with refrigerant charge for 40 deg F suction temperature; 450-psig working pressure, and 240 deg F operating temperature.

B. Solenoid Valves: Comply with ARI 760; 240 deg F temperature rating, 400-psig working pressure, 240 deg F operating temperature; and 24-V normally closed holding coil.

2.3 REFRIGERANT PIPING SPECIALTIES

A. Strainers: Welded steel with corrosion-resistant coating and 100-mesh stainless-steel screen with socket ends; 500-psig working pressure and 275 deg F working temperature.

B. Moisture/Liquid Indicators: 500-psig operating pressure, 240 deg F operating temperature; with replaceable, polished, optical viewing window and color-coded moisture indicator.

C. Filter Dryers: 500-psig operating pressure; 240 deg F operating temperature; withgaskets, and filter-dryer cartridge.

D. Mufflers: Welded steel with corrosion-resistant coating and socket ends; 500-psig operating pressure; 240 deg F operating temperature.

E. Refrigerant: R-410A.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements in Division 23 Section "Common Work Results for HVAC" for basic piping installation requirements.

B. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 23 Section "Common Work Results for HVAC" for wall penetration systems.

C. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.

D. Belowground, install copper tubing in PVC conduit. Vent conduit outdoors.

E. Insulate suction lines to comply with Division 23 Section "HVAC Insulation."

F. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

G. Install solenoid valves upstream from each thermostatic expansion valve. Install solenoid valves in horizontal lines with coil at top.

H. Install thermostatic expansion valves as close as possible to distributors on evaporator coils.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to solenoid valves, thermostatic expansion valves, and compressors unless they are furnished as an integral assembly for device being protected:

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

3.2 PIPING SCHEDULE FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type ACR, Type K, or Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, Type K, or Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

END OF SECTION 23 2300

SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 General:

A. Submittals: Submit product data on duct liner, sealing materials, and fire-stopping materials.

B. Comply with NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.

1.2 Products:

A. Sheet Metal Materials, General: Provide the following materials where indicated. Package and mark sheet metal materials as specified in ASTM A 700.

1. Galvanized Sheet Steel: Lock-forming quality, ASTM A 527, Coating Designation G 90, mill phosphatized finish for exposed surfaces of ducts exposed to view.

2. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form, with standard, one-side bright finish where ducts are exposed to view, and mill finish for concealed ducts.

B. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum ducts provide reinforcing of compatible materials.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

D. Duct Liner: Comply with NFPA Standard 90A and TIMA Standard AHC-101.

1. Materials: ASTM C 1071, Type II, with coated surface exposed to airstream to prevent erosion of glass fibers.

a. Thickness: 1/2 inch.
b. Thermal Performance: "K-Factor" equal to 0.28 or better, at a mean temperature of 75 deg F.
c. Fire Hazard Classification: Flame spread rating of not more than 25 without evidence of continued progressive combustion and a smoke developed rating of no higher than 50, when tested in accordance with ASTM C 411.

2. Liner Adhesive: Comply with NFPA Standard 90A and ASTM C 916.
3. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct. Provide fasteners that do not damage the liner when applied as recommended by the manufacturer, that do not cause leakage in the duct, and will indefinitely sustain a 50-pound tensile dead load test perpendicular to the duct wall.

a. Fastener Pin Length: As required for thickness of insulation, and without projecting more than 1/8 inch into the airstream.
b. Adhesive For Attachment of Mechanical Fasteners: Comply with the "Fire Hazard Classification" of duct liner system.

E. Joint and Seam Tape: 2 inches wide, glass-fiber-fabric reinforced.

F. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with the tape to form a hard, durable, airtight seal.

G. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 75 percent solids.

H. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

I. Hangers and Supports: Provide the following hanger and support components as indicated:

1. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.
2. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.

a. Straps and Rod Sizes: Conform with Table 4-1 in SMACNA HVAC Duct Construction Standards, 1985 Edition, for sheet steel width and gage and steel rod diameters.

3. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws, compatible with duct materials.
4. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.

a. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.
b. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

J. Rectangular Duct Fabrication: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards," Tables 1-3 through 1-19, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.

1. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

3. Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:

a. Supply Ducts: 3 inches water gage.
b. Return Ducts: 2 inches water gage, negative pressure.
c. Exhaust Ducts: 2 inches water gage, negative pressure.

4. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19 inches and larger and are 20 gage or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard," Figure 1-4, unless they are lined or are externally insulated.

K. Rectangular Duct Fittings: Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard," 1995 Edition, Figures 2-1 through 2-10.

L. Shop Application Of Liner In Rectangular Ducts: Adhere a single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is prohibited. Apply a coat of adhesive to liner facing in direction of airflow not receiving metal nosing. Butt transverse joints without gaps and coat joint with adhesive. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping. Longitudinal joints in rectangular ducts shall not occur except at corners of ducts, unless the size of the duct and standard liner product dimensions make longitudinal joints necessary.

1. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely around perimeter, at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
2. Secure transversely oriented liner edges facing the airstream with metal nosings that are either channel or "Z" profile or are integrally formed from the duct wall at the following locations:

a. Fan discharge.
b. Intervals of lined duct preceding unlined duct.

c. Upstream edges of transverse joints in ducts.

3. Terminate liner with duct buildouts installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to the duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire damper sleeve through fire separation.

M. Round Duct Fabrication: Except where interrupted by fittings, provide round ducts in lengths not less than 12 feet.

1. Round Ducts: Fabricate exposed round supply ducts with spiral lockseam construction, except where diameters exceed 72 inches. Fabricate ducts having diameters greater than 72 inches with longitudinal butt-welded seams. Comply with SMACNA "HVAC Duct Construction Standards," Table 3-2 for galvanized steel gages.

2. Round Ducts: Fabricate concealed round supply ducts using seam types identified in SMACNA "HVAC Duct Construction Standards," 1985 Edition, Figure 3-1, RL-1, RL-4, or RL-5. Seams Types RL-2 or RL-3 may be used if spot-welded on 1-inch intervals. Comply with SMACNA "HVAC Duct Construction Standards," Table 3-2 for galvanized steel gages.

3. 90-Degree Tees and Laterals and Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards," 1985 Edition, Figures 3-4 and 3-5 and with metal thicknesses specified for longitudinal seam straight duct.
4. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from the body onto branch tap entrance.
5. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:

    a. Mitered Elbows: Fabricate mitered elbows with welded construction in gages specified below.

        1) Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA "HVAC Duct Construction Standards," Table 3-1.
        2) Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from minus 2 inches to plus 2 inches:

            a) 3 to 26 inches: 24 gage.
            b) 27 to 36 inches: 22 gage.
            c) 37 to 50 inches: 20 gage.
            d) 52 to 60 inches: 18 gage.
            e) 62 to 84 inches: 16 gage.

        3) Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from 2 inches to 10 inches:

            a) 3 to 14 inches: 24 gage.
            b) 15 to 26 inches: 22 gage.
            c) 27 to 50 inches: 20 gage.
            d) 52 to 60 inches: 18 gage.
            e) 62 to 84 inches: 16 gage.

        4) Flat Oval Mitered Elbows: Solid welded and with the same metal thickness as longitudinal seam flat oval duct.
        5) 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material handling classes A and B, and only where space restrictions do not permit the use of 1.5 bend radius elbows. Fabricate with a single-thickness turning vanes.

    b. Round Elbows - 8 Inches and Smaller: Die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate

nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 3-1/2- and 4-1/2-inch) elbows with gored construction.

c. Round Elbows - 9 Through 14 Inches: Gored or pleated elbows for 30, 45, 60, and 90 degrees, except where space restrictions require a mitered elbow. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 9-1/2- and 10-1/2-inch) elbows with gored construction.

d. Round Elbows - Larger Than 14 Inches and All Flat Oval Elbows: Gored elbows, except where space restrictions require a mitered elbow.

e. Die-Formed Elbows for Sizes Through 8 Inches and All Pressures: 20 gage with 2-piece welded construction.

f. Round Gored Elbows Gages: Same as for nonelbow fittings specified above.

g. Flat Oval Elbows Gages: Same as longitudinal seam flat oval duct.

h. Pleated Elbows Sizes Through 14 Inches and Pressures Through 10 Inches: 26 gage.

1.3 Execution:

A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.

B. Install ducts with the fewest possible joints.

C. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.

D. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

E. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.

H. Install insulated ducts with 1-inch clearance outside of insulation.

I. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.

J. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

K. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

L. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

M. Seam And Joint Sealing: Seal duct seams and joints as follows:

1. Pressure Classifications Greater Than 3 Inches Water Gage: All transverse joints, longitudinal seams, and duct penetrations.
2. Pressure Classification 2 and 3 Inches Water Gage: All transverse joints and longitudinal seams.

3. Pressure Classification Less than 2 Inches Water Gage: Transverse joints only.
4. Seal externally insulated ducts prior to insulation installation.

N. Hanging And Supporting: Install and support ducts as follows unless indicated otherwise:

1. Rigid Round and Rectangular: As indicated in SMACNA "HVAC Duct Construction Standards," Tables 4-1 through 4-3 and Figures 4-1 through 4-8.
2. Horizontal Ducts: Within 2 feet of each elbow and within 4 feet of each branch intersection.
3. Vertical Ducts: At a maximum interval of 16 feet and at each floor.
4. Upper Attachments To Structures: Allow for a load not exceeding 1/4 of the failure (proof test) load, but are not limited to the specific methods indicated.

5. Install concrete insert prior to placing concrete.

6. Install powder actuated concrete fasteners after concrete is placed and completely cured.

O. Connections: Make duct connections as specified below unless indicated otherwise:

1. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-7 and 2-8.
2. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-16 through 2-18.
3. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figure 2-19.

P. Vacuum ducts systems prior to final acceptance to remove dust and debris.

END OF SECTION 23 3113

SECTION 23 3116 - NONMETAL DUCTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Low and medium pressure phenolic foam pre-insulated duct.

B. Fire, smoke and combination fire smoke dampers.

1.2 RELATED SECTIONS

A. Section 15060 - Hangers and Supports.

B. Section 15825 - Electric Duct Heater.

C. Section 15850 - Air Outlets and Inlets.

1.3 REFERENCES

A. ASHRAE - Fundamentals Handbook; Chapter 32 - Duct Design, Latest Edition.

B. ASHRAE - HVAC Systems and Equipment; Chapter 16 - Duct Construction, Latest Edition.

C. SMACNA Leakage, Class 6.

D. UL 181 - Air Duct Standards.

E. UL 555 - Fire Dampers.

F. UL555S - Smoke Dampers.

1.4 DEFINITIONS

A. Pressure Classifications:

1. Low Pressure/Low Velocity: Less than or equal to 2 inch water gauge (WG) positive or negative static pressure and velocities less than 2,500 FPM.
2. Medium Pressure/High Velocity: 2 inch WG to 9 inch water gauge (WG) positive or negative static pressure and velocities greater than 2,500 FPM.

B. Duct Sizes: Inside clear dimensions are indicated on drawings.

C. Ductwork:

1. Duct Pressure Classification: As required for the pressure available from the fan or a minimum of 2 inch WG, whichever is greater.
2. Ductwork to be sealed to SMACNA Class "A" requirements including the transverse joints, fitting connections, 45 degree takeoff connections, bellmouth connections and longitudinal seams.

3. Duct material not to exceed 25 Flame Spread and 50 Smoke Developed.

1.5 REGULATORY REQUIREMENTS

A. Construct ductwork to ANSI/NFPA 90A and 96 standards.

1.6 SUBMITTALS

A. Submit detailed ductwork coordination plans drawn to a scale of not less than 1/4 inch = 1'-0" for general building areas and 3/8 inch = 1'-0" for mechanical rooms and similar congested areas under provisions of Section 01330 - Submittal Procedures. Provide elevation views of equipment such as air handling units, fans, hoods, etc.

B. Shop Drawings: Submit detailed ductwork coordination plans drawn to a scale of not less than 1/4 inch = 1'-0" for general building areas, mechanical rooms and similar congested areas. Indicate duct routing, duct dimensions, elevation of ducts above finished floor, duct fittings, standard shop practices and particulars such as gauges, sizes welds and configuration prior to start of work.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Section 01663 Product Delivery, Storage and Handling Requirements.

B. Store and protect products under provisions of Section 01663 - Product Delivery, Storage and Handling Requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - DUCTWORK

A. Knauf Koolduct

B. No Substitutes

2.2 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT

A. Omniaire

B. Atco

C. Thermaflex

2.3 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS

A. Nailor Industries

B. Ruskin

C. Greenheck

2.4 ACCEPTABLE MANUFACTURERS - SMOKE DAMPERS

A. Nailor Industries

B. Ruskin

C. Greenheck

2.5 ACCEPTABLE MANUFACTURERS - VOLUME DAMPERS

A. Nailor Industries

B. Ruskin

C. Greenheck

2.6 ACCEPTABLE MANUFACTURERS - MOTOR ACTUATORS

A. Belimo Air Controls

2.7 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT CONNECT0R

A. Elgen

B. DuroDyne

C. Ventfabrics

2.8 ACCEPTABLE MANUFACTURERS - ACCESS DOORS

A. Bilco

B. Milcor

C. Nystrom

D. Ventfabrics

2.9 MATERIALS

A. General: on-combustible flexible materials conforming to requirements of ANSI/NFPA 90A for Class 1 air duct materials and UL 181.

B. Fasteners: Rivets, bolts or sheet metal screws. Fasteners which are visible on the diffuser or grille faces shall be furnished with the terminal device at the factory and match the finish.

C. Sealant: On-hardening, water base, fire resistive, compatible with mating materials or liquid used with tape or heavy mastic with membrane.

D. Hanger Rod: Teel, galvanized; threaded both ends, threaded one end or continuously threaded.

2.10 LOW & MEDIUM PRESSURE/LOW & HIGH VELOCITY DUCT

A. Rigid, rectangular, pre-insulated, closed cell, CFC-free phenoloic foam board conforming to SMACNA Class 6 leakage; factory molded and faced on both sides with 25 micron aluminum foil reinforced with a 5 mm glass tissue mesh; and aluminum flanges. Duct to contain UL label and other markings required by UL 181 on each full sheet of duct board; UL ratings for closure materials. Temperature limits to be 250 Degree F inside duct and 150 Degree F ambient temperature surrounding duct.

B. Thermal Conductivity: 'K' value of 0.13 at 75 Degree F.

C. Moisture Absorption: Not to exceed 5 percent by weight at 120 Degree F and 95 percent relative humidity for 96 hours when tested in accordance with ASTM C-423.

D. Vapor Barrier Permeability: 0.02 perms maximum when tested in accordance with ASTM E96, Procedure A.

E. Noise Reduction Coefficient: 0.65 minimum when tested in accordance in accordance with ASTM C423, Mounting A.

F. Reinforcements:

1. Tie-Rod Reinforcements: 0.108 inch galvanized-steel wire of length to suit termination method.
2. Reinforcing Rod Washers: 2-1/2 inch square by 0.028 inch thick, galvanized-steel washer with turned edges and volcano-type center hole.
3. Sag-Control Supports: 1/2 inch galvanized steel conduit.

G. Joint Closure Sealing:

1. Minimum 2-1/2 inch wide pressure sensitive tape, glass-fiber-reinforced, aluminum-foil tape complying with UL 181A, Part P and imprinted with required information.
2. Heat Activated Tape: Minimum 2-1/2 inch wide, glass-fiber-reinforced, foil scrim tape complying with UL 181A, Part H and imprinted with required information.
3. Mastic and Glass Fabric: Minimum 3 inch wide glass fabric and duct manufacturer's recommended mastic that complies with UL 181.

H. Construct tee's, bends and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular or miter elbows are used, provide single thickness air foil turning vanes. The use of double wall air foil turning vanes shall be approved if there is no increase in cost.

I. Increase duct sizes gradually, not exceeding 22.5 degree air divergence wherever possible. Ensure air divergence upstream of equipment does not exceed 30 degree. Ensure convergence downstream of equipment does not exceed 45 degree.

J. Construct all branch takeoffs from both the supply and return mains and sub-mains with 45 degree branch takeoff fittings equipped with volume control dampers. Should 45 degree branch takeoffs not be appropriate, two-piece bellmouth or conical takeoffs with volume control dampers will be acceptable.

K. Connect flexible ducts to phenolic foam ducts with adhesive, draw-band and foil faced duct tape.

L. Seal all transverse joints, longitudinal seams and duct wall penetrations.

M. Provide easements where low pressure ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.

N. Use double nuts and lock washers on threaded rod supports.

O. Fabricate rectangular ducts and fittings from duct boards.

P. Fabricate mitered elbows with turning vanes.

Q. All branch takeoff connections on supply ducts shall contain volume control dampers in branch ducts.

R. Attach metal components to phenolic foam ducts with galvanized steel washers on opposite surfaces of duct walls.

2.11 FLEXIBLE AIR DUCT

A. UL 181, Class 1 commercial grade flexible duct rated for 10 inch WG having a minimum R-6 rating and constructed of a vinyl interior liner supported by helically wound spring steel wire with flexible high density glass fiber insulation and enclosed with a metalized spiral reinforced vapor barrier jacket; Model 1200 manufactured by Omniair, Model UPC #016 manufactured by Atco, Series MKE manufactured by Thermaflex or approved equal. Hard duct drops will not be approved unless waived by the Owner prior to design.

B. Provide flexible duct in one-piece, 2 feet minimum and not to exceed 8 linear feet. Spliced flexible duct is PROHIBITED.

2.12 TURNING VANE

A. Single thickness, galvanized steel type air foil turning vanes for sizes up to 24 inches in depth and cataloged by a recognized air distribution equipment manufacturer. Provide double thickness air foil turning vanes for sizes greater than 24 inches in depth or in all instances where there is no increase in cost over the single thickness air foil turning vanes. Provide at all 90 degree square elbows.

2.13 FIRE DAMPER

A. UL 555, dynamic curtain type, 165 Degree F fusible link fire damper with 22 gauge galvanized steel channel frame, 22 gauge galvanized steel blades, S-slip joint breakaway connection (furnished by Contractor), UL test label with a 1-1/2 hour fire protection rating for

penetrations in 1 hour and 2 hour rated partitions and a 3 hour fire protection rating for penetrations in a 3 hour rated partition. Model D0120 as manufactured by Nailor, Model DIBD2 as manufactured by Ruskin for 1 and 2 hour fire protection rating or approved equal. Model D0520 as manufactured by Nailor, Model DIBD23 as manufactured by Ruskin for 3 hour fire protection rating or approved equal.

B. Electrical installation shall be performed by the fire alarm specialist and shall comply with Division 16.

2.14 SMOKE DAMPER

A. UL 555S, Class II leakage smoke damper with 16 gauge galvanized steel hat channel frame with mitered corners reinforced and strengthened with die formed corner gussets, 14 gauge galvanized steel double skin opposed blades, concealed linkage, 1/2 inch plated steel hex axles double thru-bolted at each end of blade to provide positive locking connection, stainless steel sleeve bearings, factory mounted UL approved electric actuator, S-slip joint breakaway connection (furnished by Contractor), UL test label with a 1-1/2 hour fire protection rating for penetrations in 1 hour and 2 hour rated partitions, and a 3 hour fire protection rating for penetrations in a 3 hour rated partition. Model 1210 as manufactured by Nailor, Model SD36 as manufactured by Ruskin or approved equal.

B. Electrical installation shall be performed by the fire alarm specialist and shall comply with Division 16.

2.15 OUTSIDE AIR MAKEUP CONTROL DAMPER

A. Low leakage extruded 6063T5 aluminum hat channel frames with mitered corners and die formed internal braces for rigidity and structural strength; 6 inch depth airfoil type extruded aluminum opposed blades with integral full length structural, reinforcing tubes; blade edge and jam seals of extruded vinyl double edge design; locking quadrant and molded synthetic bearings; 1/2 inch stainless steel hex axles secured tight to airfoil blade; 6 inch x 1/2 inch diameter galvanized steel control shaft with outboard support bearings and actuator linkage concealed in frame. Dampers capable of moving freely through a full 90 degree arc. Model CD-50 as manufactured by Ruskin or approved equal.

B. Opposed blade type dampers are to be provided when duct dimensions are greater than 12 inches in depth. Parallel blade type dampers may be provided when duct dimensions are no greater than 48 inches wide x 12 inches depth.

C. Maximum leakage rates shall not exceed the values when tested at 1 inch WG pressure differential in accordance with AMCA Publication 500.

2.16 OUTSIDE AIR MAKEUP CONTROL DAMPER MOTOR ACTUATOR

A. 24 Volt spring return to close, heavy duty, direct coupled electric actuator motor with minimum 75 Inch Lb. of torque, visual position indicator, mounted outside of duct. Actuator to be as manufactured by Belimo, Johnson Controls or Siemens Builiding Technologies. Refer to Specification Section 15900 - HVAC Instrumentation and Controls.

2.17 MANUAL VOLUME CONTROL DAMPER

A. 16 gauge galvanized steel channel frames, 5inch wide x 16 gauge galvanized steel blades with molded synthetic bearings, 1/2 inch stainless steel hex axles double thru-bolted at each end of blade, 2 inch high standoff brackets on quadrants for insulated duct. Dampers capable of moving freely through a full 90 degree arc. Model 1820 as manufactured by Nailor, Model MD-35 as manufactured by Ruskin or approved equal.

B. Opposed blade type dampers are to be provided when duct dimensions are greater than 12 inches in depth. Parallel blade type dampers may be provided when duct dimensions are no greater than 48 inches wide x 12 inches depth.

2.18 ACCESS PANEL (DUCT MOUNTED)

A. Minimum 18 inch x 18 inch or maximum size permitted by duct, square gasketed panels of 18 gauge galvanized steel at all locations requiring access to control devices and upstream of coil, electric duct heaters, smoke detectors, motor operated dampers and filters and at a distance of 25 feet from the AHU discharge on both the supply and return air ductwork.

B. Access doors shall be hinged with cam latches and fully gaseketed to the perimeter.

2.19 FLEXIBLE DUCT CONNECTOR

A. 22 ounce neoprene coated fiberglass fabric connectors with a minimum tear and tensile strength of 110 Lbs. and 250 Lbs, respectfully. Provide in 6 inch minimum to 10 inch maximum lengths at all duct connections to rotating or vibrating equipment such as air handler units, unit ventilators, etc. Model "Silent Duct" manufactured by Elgen Manufacturing Corporation.

2.20 DUCT HANGER STRAPS

A. 1 inch gauge galvanized steel fastened with screws to rectangular ducts and with a bolt to round ducts.

B. Stainless steel suspension cable with ratchet as manufactured by Gripplle or approved equal.

2.21 HANGERS AND SUPPORTS

A. Concrete inserts, powder-actuated fasteners or structural steel fasteners appropriate for construction materials to which hangers are being attached to.

B. Use powder-actuated concrete fasteners for standard weight aggregate concretes or floor slabs more than 4 inches thick. Do not use powder-actuated concrete fasteners if the slab is less than 4 inches thick.

2.22 LOUVERS (EXTERIOR WALL)

A. Refer to Section 15850 - Air Outlets and Inlets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install ducts under provisions of the manufacturer's instructions and with a minimum number of joints.

B. Install ducts vertically, horizontally, parallel and perpendicular to the building lines.

C. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

D. Set plenum doors 6 inches to 12 inches above floor or side of duct. Arrange door swing so that fan static pressure holds door in a closed position.

E. Attach hangers to concrete floor slabs by the use of drilled concrete anchored fasteners after the concrete slab has cured. The use of powder actuated fasteners is PROHIBITED.

F. Attach hangers to joints and reinforcing channels that occur within required hanger spacing. Attach hangers to transmit load to sides and bottom channels and no more than 6 inches from sides of ducts.

G. Install ducts with a clearance of 1 inch and as close to the walls, overhead construction, columns and other structural and permanent enclosure elements of the building.

H. Support horizontal ducts with trapeze-type hangers.

I. Support equipment and duct components and accessories independent of ducts.

J. Locate ducts with sufficient space around the air handler unit to allow normal operating and maintenance activities.

K. Connect supply air diffusers and return air grilles to low pressure ducts with 8 feet maximum length of flexible air duct. Should the duct length from the duct takeoff to the supply air diffuser or return air grille exceed 8 feet in length, the difference in length shall be provided with the use of rigid duct of an equivalent cross sectional area.

L. Install flexible air duct without sharp bends. Minimum centerline radius to be not less than the duct diameter as recommended by SMACNA. Replace crushed or deformed flexible air ducts. Secure ducts with drawbands, foil faced silver tape and mastic at takeoffs and diffusers.

M. During construction, provide temporary closures on all open ductwork by sealing with a disposable polyethylene sheet to prevent construction dust from entering ductwork system.

N. Do not install ductwork inside buildings until the building is weather-tight. Replace weather damaged ductwork at no cost to the Owner without any time extension to the Contractor.

O. Provide all necessary structural steel hangers, sheet metal flanges and reinforcements required to install the electric duct heater and other equipment in the duct system.

P. Do not support ductwork from joist cross and lateral bracing or from galvanized steel decking. Should the deck be constructed of concrete, support from the concrete deck will be permitted.

Q. On constant air volume system designs, provide a motor-operated, low leakage outside air makeup damper and a manual control volume damper on the outside air makeup ducts connected to the mechanical room air handling unit. See the mechanical plans for the approximate location of the dampers and fan. Electrical connection to be performed by electrician. Refer to Division 16.

R. On variable air volume system designs, provide a motor-operated, low leakage outside air makeup damper, a manual control volume damper and an inline fan on the outside air makeup duct connected to the mechanical room air handling unit. See the mechanical plans for the approximate location of the dampers and fan. Electrical connection to be performed by electrician. Refer to Division 16.

S. Install fire or smoke dampers in accordance with code. Dampers to be dynamic type (static dampers are not approved) and self-supporting designed to provide a positive barrier to air passage when in a closed position. Dampers to be provided by the sheetmetal contractor and shall be of the S-slip joint breakaway type connection. Secure all dampers with retaining angles fastened to the sleeve in the wall or floor penetration. Electrical connections to be performed by fire alarm specialist. Refer to Division 16.

T. Wall or floor penetrations for fire, smoke or combination fire/smoke dampers shall not be more than 1/8 inch per foot larger on each side of the sleeve penetrating the opening.

U. Where ductwork penetrates a rated wall, seal airtight the annular space between the duct and the wall by filling it with stuffing insulation. Also seal airtight the perimeter of the smoke damper with a UL approved sealant such as Dow-Corning 999, Dow-Corning Silastic 732 RTV or GE RTV 108.

V. After completion of the fire, smoke and/or the combination fire smoke damper installation, remove the screws provided on the S-slip joint duct breakaway connection used during installation.

3.2 ADJUSTING AND CLEANING

A. Protect AHU equipment which may be harmed by excessive dirt with temporary 4 inch depth, 60-65 percent ADS disposable filters during cleaning. Refer to Section 15860 - Air Cleaning Devices.

B. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION 23 3116

SECTION 23 3300 - DUCT ACCESSORIES

1.1 GENERAL

A. Submittals: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data for backdraft dampers, manual volume control dampers, fire and smoke dampers, duct-mounted access panels and doors, and flexible ducts and connectors.
2. Shop drawings for special fittings and volume control damper installations and fire and smoke damper installations, including sleeves and duct-mounted access door and panel installations.

B. Quality Assurance: Comply with the following Standards:

1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

1.2 PRODUCTS

A. Backdraft Dampers: Suitable for horizontal or vertical installation.

1. Frame: 18-gage galvanized steel, with welded corners.
2. Frame: 0.063-inch-thick 6063T extruded aluminum.
3. Blades: 0.025-inch-thick roll-formed aluminum.
4. Blades: 0.050-inch-thick 6063T extruded aluminum.
5. Blade Seals: Felt.
6. Blade Seals: Vinyl.
7. Blade Seals: Neoprene.
8. Blade Axles: Nonferrous.
9. Blade Axles: Galvanized steel.
10. Tie Bars and Brackets: Aluminum.
11. Tie Bars and Brackets: Galvanized steel.
12. Return Spring: Adjustable tension.
13. Chain Operator: 15-foot-long galvanized-steel sash chain and pulley.
14. Wing-Nut Operator: Galvanized steel, with 1/4-inch galvanized-steel rod.

B. Manual Volume Control Dampers: Factory-fabricated multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications. Stiffen damper blades to provide stability under operating conditions. Provide locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class. Provide end bearings or other seals for ducts with pressure classifications of 3 inches or higher. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft.

1. Steel Frames: Hat-shaped, galvanized-steel channels, minimum of 16 gage, and with mitered and welded corners. Provide frames with flanges where indicated for attaching to walls. Provide flangeless frames where indicated for installation in ducts.
2. Roll-Formed Steel Blades: 16-gage galvanized steel.
3. Blade Axles: Galvanized steel.
4. Tie Bars and Brackets: Galvanized steel.

C. Damper Control Hardware: Zinc-plated, die-cast core with a heavy-gage dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Provide center hole to suit damper operating rod size. Provide elevated platform for insulated duct mounting.

D. Fire Dampers: UL labeled according to UL Standard 555 "Standard for Fire Dampers."

1. Fire Rating: 1-1/2 or 3 hours, as indicated.

2. Frame: Type A or Type B; fabricated with roll-formed, 21-gage, galvanized steel; with mitered and interlocking corners.
3. Mounting Sleeve: Factory-installed or field-installed, galvanized steel.

   a. Minimum Thickness: 0.056-inch (16-gage) or 0.138-inch (10-gage) thick as indicated, and length to suit application.
   b. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of the wall or floor, and thickness of damper frame meets sleeve requirements.

4. Mounting Orientation: Vertical or horizontal as indicated.
5. Blades: Roll-formed, interlocking, 21-gage galvanized steel. In place of interlocking blades, provide full-length, 21-gage, galvanized-steel blade connectors.

6. Horizontal Dampers: Include a blade lock and stainless steel negator closure spring.

7. Fusible Link: Replaceable, 165 deg F or 212 deg F rated as indicated.

E. Ceiling Fire Dampers: UL listed and labeled; comply with the construction details for the tested floor/roof-ceiling assemblies as indicated in the UL Fire Resistance Directory.

1. Frame: 20-gage, rectangular or round, galvanized steel; style to suit ceiling construction.
2. Blades: 22-gage galvanized steel with nonasbestos refractory insulation.

3. Fusible Link: Replaceable, 165 deg F rated.
4. Fusible Link: Replaceable, 212 deg F rated.
5. Fusible Link: Replaceable, 285 deg F rated.

F. Smoke Dampers: UL-labeled according to UL Standard 555S, "Standard for Leakage Rated Dampers for Use in Smoke Control Systems." Combination fire and smoke dampers shall also be UL-labeled for 1-1/2 hour rating according to UL Standard 555 "Standard for Fire Dampers." Refer to the Smoke Damper Schedule at the end of this Section for leakage classification, temperature category, and other characteristics.

1. Fusible Link: Replaceable, 165 deg F or 212 deg F rated as indicated.
2. Frame and Blades: 16-gage galvanized steel.
3. Mounting Sleeve: Factory-installed, 18-gage galvanized steel; length to suit wall or floor application.

G. Actuators: Provide motors for smooth modulating or 2-position action.

1. Permanent-Split-Capacitor or Shaded-Pole Motors: Provide with oil-immersed and sealed gear trains.
2. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 inch-pounds and breakaway torque rating of 150 inch-pounds.
3. Outdoor Motors and Motors in Outside Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
4. Non-Spring Return Motors: For dampers larger than 25 square feet, size motor for running torque rating of 150 inch-pounds and breakaway torque rating of 300 inch-pounds.

5. 2-Position Motor: 115 V, single phase, 60 Hz.
6. 2-Position Motor: 230 V, single phase, 60 Hz.
7. 2-Position Motor: 230 V, 3 phase, 60 Hz.
8. 2-Position Motor: 460 V, 3 phase, 60 Hz.
9. Modulating, Spring Return Motor: 115 V, single phase, 60 Hz.
10. Modulating, Spring Return Motor: 230 V, single phase, 60 Hz.
11. Modulating, Spring Return Motor: 230 V, 3 phase, 60 Hz.
12. Modulating, Spring Return Motor: 460 V, 3 phase, 60 Hz.

H. Turning Vanes: Fabricate turning vanes according to SMACNA HVAC Duct Construction Standards, Figures 2-2 through 2-7.

1. Manufactured Turning Vanes: Fabricate of 1-1/2-inch-wide, curved blades set at 3/4 inch on center, support with bars perpendicular to blades set at 2 inches on center, and set into side strips suitable for mounting in ducts.
2. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fiber glass fill.

I. Duct-Mounted Access Doors and Panels: Refer to the Access Door Materials Schedule at the end of this Section for frame and door thickness, number of hinges and locks, and location of locks. Provide construction and airtightness suitable for duct pressure class.

1. Frame: Galvanized sheet steel. Provide with bend-over tabs and foam gaskets.
2. Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of hinges and locks as indicated for duct pressure class. Provide vision panel where indicated. Provide 1-inch by 1-inch butt hinge or piano hinge and cam latches.
3. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.

4. Insulation: 1-inch thick fiber glass or polystyrene foam board.

J. Flexible Connectors: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.

1. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 24-gage, galvanized sheet steel or 0.032-gage aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1st Edition, Figure 2-19.

2. Conventional, Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloroprene.

a. Minimum Weight: 26 oz. per sq yd.
b. Tensile Strength: 480 lb per inch in the warp and 360 lb per inch in the filling.

3. Conventional, Outdoor System Flexible Connectors Fabric: Glass fabric double coated with DuPont's HYPALON or other synthetic-rubber weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.

a. Minimum Weight: 26 oz. per sq yd.
b. Tensile Strength: 530 lb per inch in the warp and 440 lb per inch in the filling.

c. High-Temperature System Flexible Connectors: Glass fabric coated with silicone rubber and having a minimum weight of 16 oz. per sq yd and tensile strength of 285 lb per inch in the warp, and 185 lb per inch in the filling.

d. High-Corrosive-Environment System Flexible Connectors: Glass fabric coated with a chemical-resistant coating.
e. Minimum Weight: 14 oz. per sq yd.
f. Tensile Strength: 450 lb per inch in the warp and 340 lb per inch in the filling.

K. Flexible Ducts: Comply with UL 181, Class 1.

1. Flexible Ducts - Uninsulated: Spiral-wound steel spring with flameproof vinyl sheathing.
2. Flexible Ducts - Uninsulated: Corrugated aluminum.
3. Flexible Ducts - Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch-thick, glass fiber insulation around a continuous inner liner.

a. Reinforcement: Steel-wire helix encapsulated in the inner liner.
b. Outer Jacket: Glass-reinforced, silver mylar with a continuous hanging tab, integral fiber glass tape, and nylon hanging cord.
c. Outer Jacket: Polyethylene film.
d. Inner Liner: Polyethylene film.

L. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket and a flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide in length to suit duct insulation thickness.

M. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch; zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

N. Flexible Duct Clamps: Stainless steel band with cadmium-plated hex screw to tighten band with a worm-gear action. Provide in sizes from 3 to 18 inches to suit duct size.

O. Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline and grease.

1.3 EXECUTION

A. Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards.

B. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install fire and smoke dampers according to the manufacturer's UL-approved printed instructions.

E. Install fusible links in fire dampers.

F. Label access doors according to Division 15 Section "Mechanical Identification."

END OF SECTION 23 3300

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. In-line centrifugal fans.
   2. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on 800 feet above sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Fan speed controllers.

B. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck
2. Twin City
3. Loren Cook
4. Penn Barry

2.2 IN-LINE CENTRIFUGAL FANS

A. Description: In-line, direct or belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing[; with wheel, inlet cone, and motor on swing-out service door.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
   3. Companion Flanges: For inlet and outlet duct connections.
   4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
   5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

G. Capacities and Characteristics: See equipment schedules on drawings.

2.3 PROPELLER FANS

A. Description: Direct- or belt-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.

B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.

D. Fan Wheel: Replaceable, cast-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

   1. Service Factor Based on Fan Motor Size: 1.4.
   2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
      a. Ball-Bearing Rating Life: ABMA 9, L10 of 100,000 hours.
   4. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
   5. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
   6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
   7. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

F. Accessories:

   1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
   2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
   3. Wall Sleeve: Galvanized steel to match fan and accessory size.
   4. Weathershield Hood: Galvanized steel to match fan and accessory size.
   5. Weathershield Front Guard: Galvanized steel with expanded metal screen.
   6. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

7. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

G. Capacities and Characteristics: See equipment schedules on drawings.

2.4 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

2.5 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 – EXECUTION

3.1 INSTALLATION

A. Support units using elastomeric mounts having a static deflection of 1 inch. Vibration- control devices are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

B. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 23 3416

SECTION 23 3713 - DIFFUSERS, REGISTERS, AND LOUVERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Linear slot diffusers.
4. Modular core supply grilles.
5. Adjustable side wall registers and grilles.

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Titus
2. Nailor
3. Price
4. Kreuger
5. Metalaire

2.2 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Size: 24 by 24 inches (600 by 600 mm).
5. Face Style: Plaque Face.
6. Mounting: Surface or T-bar to match ceiling type.
7. Pattern: Adjustable.
8. Dampers: None.
9. Accessories:

2.3 CEILING LINEAR SLOT OUTLETS

A. Linear Slot Diffuser:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material - Shell: Steel, insulated.
3. Material - Pattern Controller and Tees: Aluminum.
4. Finish - Face and Shell: Baked white enamel, black.
5. Slot Width: 1 inch (19 mm).
6. Number of Slots: Two as indicated.
7. Length: as indicated on drawings.

2.4 REGISTERS AND GRILLES

A. Adjustable Side Wall Register:

1. Material: Steel.
2. Finish: Baked enamel, white.
3. Face Blade Arrangement: Vertical spaced 3/4 inch (19 mm) apart.
4. Core Construction: Removable.
5. Rear-Blade Arrangement: Horizontal spaced 3/4 inch (19 mm) apart.
6. Frame: 1-1/4 inches (32 mm) wide.
7. Mounting: Countersunk screw.
8. Damper Type: Adjustable opposed blade.
9. Accessories:
   a. Front-blade gang operator.
   b. Filter.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 3713

SECTION 23 5400 – FURNACES

1.1 GENERAL

A. Submittals: Submit Product Data for each furnace including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories according to the Conditions of the Contract and Division 1 Specification Sections.

B. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

1.2 PRODUCTS

A. Furnaces, General: Factory assembled, piped, wired, and tested.

1. Configuration: Upflow.
2. Cabinet: Steel with foil-faced, glass-fiber, interior insulation. Lift-out panels expose burners and all other items requiring access for maintenance.
3. Finish of External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
4. Fan: Centrifugal, factory balanced, resilient mounted.
5. Fan Motors: Multitapped, multispeed, with internal thermal protection and permanent lubrication.

B. Gas-Fired Furnaces, "Medium" Efficiency: Comply with AGA Z21.47, "Gas-Fired Central Furnaces"; and NFPA 54, "National Fuel Gas Code."

1. AGA Approval: Bear label of American Gas Association.
2. Type of Gas: Natural.
3. Efficiency: 90 percent AFUE, minimum.
4. Heat Exchanger: Aluminized and stainless steel.
5. Burner: Inshot type.

   a. Gas Valve: 100 percent safety gas shutoff; 24-V combining pressure regulation, safety pilot, manual set (ON-OFF), pilot filtration, and automatic electric valve.
   b. Ignition: Electronic pilot ignition, with electric spark igniter.

7. Gas Burner Safety Controls: As follows:

   a. Thermocouple Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
   b. Vent Safety Pressure Switch: Prevents operation in case of blockage of combustion air, flue outlet, or condensate drain.
   c. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic resets.

8. Venting: Power venting, using integral centrifugal fan.
9. Automatic Controls: Solid-state board delays fan start and fan shutdown.

C. Controls: Include components required for satisfactory operation of furnaces and auxiliary equipment in all seasons.

1. Control Transformer: 24 VAC output, factory installed, and wired in furnace.

2. Thermostat: 24 VAC, solid-state, programmable, microprocessor-based wall mounting unit with automatic switching from heating to cooling, preferential rate control, multiple temperature presets selectable by day and time, and battery back-up protection of program settings against power failure.
3. Relays: As required to achieve specified operation.
4. Wire and Cable: Specified in Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

D. Filters: 1-inch- (25-mm-) thick, disposable, fiberglass type in sheet metal rack.

E. Evaporator Coil: Conform to ARI 210/240, "Unitary Air Conditioning and Air Source Heat Pump Equipment." Match size with furnace. Match remote condensing unit specified in Division 23 Section "Packaged Compressor and Condensing Units" with type, capacity, pressure-drop ratings, restricted distributor, or expansion valve. Include condensate drain pan with accessible drain outlet.

F. Evaporator Coil Enclosure: As required to suit furnace and cooling coil. Steel cabinet with access panel and flanges for integral mounting at or on furnace cabinet.

G. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; with insulated suction line and flared fittings at evaporator end; no fitting at condenser end; length as required.

1.3 EXECUTION

A. Install furnaces and accessories according to manufacturer's written instructions.

B. Install and connect gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's published installation instructions.

1. Connect gas piping according to Division 23 Section "Facility Natural Gas Piping."
2. Vents, Outside-Air Pipe Connections, and Drains: Where polyvinyl chloride (PVC) piping is used, install according to Division 23 Section "Common Work Results for HVAC." Install vent terminal designed to protect against birds, insects, and dirt.
3. Connect condensate drain pans using copper tubing, ASTM B 88, Type M (ASTM B 88M, Type C) with streamline drainage fittings and soldered joints or PVC drainage piping. Extend to nearest equipment drain or floor drain. Construct vented, deep trap at connection to drain pan and install cleanouts at changes in direction. Terminate to suit local code requirements, except where stricter methods are indicated.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base where installation conditions require.

D. Controls: Install thermostats and humidistats at mounting height of 60 inches (1500 mm) above floor.

E. Control Wiring: Install control wiring as specified in Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

F. Connect ducts according to Division 23 Section "Metal Ducts."

G. Identify furnaces and connections according to Division 23 Section "Common Work Results for HVAC."

H. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Gas Piping: Conform to applicable requirements of Division 23 Section "Facility Natural Gas Piping." Connect gas piping to boiler, full size of boiler gas train inlet, and provide union with sufficient clearance for burner removal and service.
3. Refrigerant Tubing: Conform to applicable requirements of Division 23 Section "Refrigerant Piping." Connect refrigerant tubing to coils and condensing units.

I. Electrical: Conform to applicable requirements of Division 26 Sections.

1. Install electrical devices provided with furnace but not specified to be factory mounted.

J. Connect motors and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION

SECTION 23 8126 – SPLIT SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes evaporative condensers.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 15 Section "Hydronic Piping" for equipment piping requirements.
2. Division 15 Section "Vibration Control" for equipment vibration isolation requirements.
3. Division 15 Section "Condenser Water Treatment System" for chemically treating the unit's recirculated water.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each unit, including rated capacities, pressure drop, fan performance data, weights (shipping, installed, and operating), installation instructions, and startup instructions.

C. Shop drawings for each unit, indicating dimensions, weight loadings, weight distribution, and clearances required around and between construction elements such as beams, columns, and walls.

D. Coordination drawings indicating structural supports, piping rough-in requirements, wiring rough-in requirements (determine spaces reserved for electrical equipment), and access requirements around other work (including working clearances to mechanical controls and electrical equipment).

E. Wiring diagrams for power supply wiring to equipment and ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between factory-installed and field-installed wiring.

F. Maintenance data for each unit, including parts lists for unit coil, water distribution system, pump, fans, bearings, fan drives, vibration isolators, controls, basin heaters, and all accessories.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has successfully installed evaporative condensers similar in design, size, and extent to those indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Firm experienced in manufacturing evaporative condensers similar to those indicated for this Project and with a record of successful in-service performance.

C. Manufacturer Certification: Certify unit's capacity in writing, based on factory performance tests.

D. ASME Compliance: Comply with ASME 1992 "Boiler and Pressure Vessel Code," Section VIII, Division 1, "Basic Coverage" for constructing and testing condenser pressure vessels. Stamp with ASME mark.

E. NEC Compliance: Comply with applicable NEC requirements pertaining to electrical power and control wiring.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Protect units from damage during shipping and handling with factory packaging.

B. Site Acceptance: Reject damaged units upon arrival. Do not install damaged units or components. Replace with new ones.

C. Rigging: Rig units for unloading and moving as recommended by the equipment manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering units that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide units by one of the following:

1. Baltimore Aircoil Company, Inc.
2. Evapco Inc.
3. Recold, A Division of the Marley Cooling Tower Company.

2.2 COMPONENTS

A. Coil: Steel surface, designed for low pressure drop and free drainage of liquid, hot-dip galvanized after fabrication. Pressure test coils at 350 psig (2412 kPa) air under water.

B. Drift Eliminator Material: Formed PVC; resistant to rot, decay, and biological attack; with a maximum flame spread rating of 5 per ASTM E 84.

C. Drift Eliminator Material: Hot-dipped galvanized steel with polymer coating.

D. Drift Eliminator Material: Galvanized steel conforming to ASTM A 525 (ASTM A 525M), Coating Designation G 210 (Z 600).

E. Drift Eliminator Material: Stainless steel.

F. Hot Water Distribution System: Ensures even distribution of water over fill.

1. Piped Distribution Manifold: Galvanized-steel pipe header and removable, galvanized-steel pipe branches, or Schedule 40 PVC pipe header and removable, Schedule 40 PVC pipe branches.
2. Piped Distribution Manifold: Galvanized-steel pipe header and removable, galvanized-steel pipe branches.
3. Piped Distribution Manifold: Schedule 40 PVC pipe header and removable, Schedule 40 PVC pipe branches.
4. Nozzles: Removable plastic, brass, or ceramic nozzles.

G. Inlet Screen: Galvanized-steel mesh, hot-dipped galvanized steel mesh with polymer coating, or stainless-steel mesh; mounted on removable frame.

H. Inlet Screen: Galvanized-steel mesh mounted on removable frame.

I. Inlet Screen Material: Hot-dipped galvanized-steel mesh with polymer coating mounted on removable frame.

J. Inlet Screen Material: Stainless-steel mesh mounted on removable frame.

K. Basin Heaters: Sized to maintain basin water temperature at 40 deg F (5 deg C) when ambient temperature is 0 deg F (minus 15 deg C) and wind velocity is 10 mph (16 km/h).

L. Heater: Hot water; entering temperature 180 deg F (85 deg C).

M. Heater: Steam; minimum pressure of 5 psig (35 kPa).

N. Heater: Electric immersion heaters with thermostat and low-water cutout, enclosed in weatherproof housing suitable for field wiring.

O. Circulating Pumps: Centrifugal, close-coupled, bronze-fitted, with mechanical seal; mounted vertically to drain completely when unit pan is drained and piped to spray header and suction strainer.

P. Water Level Control: Standard mechanical makeup water valve and a plastic or bronze float with an adjustable linkage.

Q. Water Level Control: Electric float switch, characteristics coordinated with the supplier of the solenoid-operated, makeup water valve.

R. Water Level Control: Electric float switch and solenoid makeup valve.

S. Fan: Propeller.

T. Fan: Centrifugal.

U. Fan: Propeller or centrifugal.

1. Bearings: Self-aligning ball bearings or bronze sleeve bearings, with external, extended grease lines and fittings.
2. Blade: Cast aluminum with adjustable pitch.
3. Blade: Cast aluminum with fixed pitch.
4. Blade: Galvanized steel with fixed pitch.
5. Drive: Gear drive with speed reducer.
6. Drive: Belt drive.

7. Drive: Gear drive with speed reducer or belt drive.
8. Motor: Open, dripproof, energy-efficient motor conforming to NEMA MG 1.
9. Motor: Totally enclosed, fan-cooled, energy-efficient motor conforming to NEMA MG 1.
10. Motor: Totally enclosed, air-over, energy-efficient motor conforming to NEMA MG 1.
11. Motor Speed: Single speed.
12. Motor Speed: Two speed.
13. Motor Speed: Single speed, suitable for a variable-speed drive.
14. Vibration Cutout Switch: De-energizes fan motors if excessive vibration occurs due to fan imbalance.

V. Discharge Dampers and Controls: Galvanized steel with airfoil capacity control dampers, linkages, electric damper operator, controller, end switches, transformer, and weatherproof enclosure.

2.3 FABRICATION

A. Fabricate evaporative condensers using manufacturer's standard design, materials, and construction in accordance with published product information.

B. Configuration: Forced draft.

C. Configuration: Induced draft.

D. Casing Material: Hot-dipped galvanized steel with polymer coating or galvanized steel conforming to ASTM A 525 (ASTM A 525M) Coating Designation G 210 (Z 600).

E. Casing Material: Hot-dipped galvanized steel with polymer coating.

F. Casing Material: Galvanized steel; conforming to ASTM A 525 (ASTM A 525M). Coating designation G 210 (Z 600).

G. Casing Material: Stainless steel.

1. Fasteners: Corrosion resistance equal to or better than the materials being fastened.
2. Seal all joints watertight.
3. Make welded connections continuous and water tight.
4. Rigging supports allow handling evaporative condensers at construction site.

H. Collecting Basin: Galvanized steel conforming to ASTM A 525 (ASTM A 525M), Coating Designation G 210 (Z 600) hot-dipped galvanized steel with polymer coating.

I. Collecting Basin: Galvanized steel conforming to ASTM A 525 (ASTM A 525M), Coating Designation G 210 (Z 600).

J. Collecting Basin: Hot-dipped galvanized steel with polymer coating.

K. Collecting Basin: Stainless steel.

1. Removable basin strainer with openings smaller than nozzle orifices.
2. Overflow connection.
3. Makeup water connection.
4. Oversized drain connection for a remote sump.
5. Side drain connection.
6. Bottom drain connection.

L. Vibration Control: Direct isolation (no base) and vibration isolators recommended by manufacturer.

M. Vibration Control: Direct isolation (no base) and the following vibration isolators as referenced in Chapter 42 of the 1991 ASHRAE "Handbook--Heating, Ventilating, and Air-Conditioning Applications":

1. Vibration Isolators: Rubber mounts (Type 2), minimum deflection of 0.25 inch (6 mm).
2. Vibration Isolators: Restrained-spring isolators (Type 4), minimum deflection of 0.75 inch (19 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive equipment for compliance with requirements for installation tolerances and other conditions affecting unit performance. Examine proposed route of moving equipment into place and verify that it is free of interferences. Verify piping rough-in locations. Verify branch circuit wiring suitability. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Final locations of equipment on the Drawings are approximate, unless dimensioned. Determine exact locations before roughing-in piping and electrical work.

3.2 INSTALLATION

A. Install equipment according to manufacturer's written instructions.

B. Install and anchor equipment plumb and level.

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Install vibration isolators according to isolator manufacturer's recommendations.

E. Install flexible pipe connections for units mounted on vibration isolators.

F. Install piping connections, maintaining clearances for service and maintenance of equipment.

G. Install flanged or union connections at evaporative condenser.

H. Pitch piping down to drain into sump.

I. Install shutoff valves at inlet and outlet connections.

J. Connect overflow drain and bleed lines to storm drainage system.

K. Connect overflow drain and bleed lines to sanitary sewage system.

L. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted, such as remote, electronic water-level controller; equipment control panel; and remote, basin-water-heater control panel. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide a factory-authorized service representative to supervise the field assembly of components and installation of units, including piping and electrical connections, and to report results in writing.

3.4 DEMONSTRATION

A. Startup Services: Provide a factory-authorized service representative to start up service and to demonstrate and train Owner's maintenance personnel on procedures and schedules related to startup, shutdown, troubleshooting, servicing, and preventive maintenance.

3.5 CLEANING

A. Clean units using materials and methods recommended by manufacturer.

B. Clean finishes to remove dust and dirt.

C. Touch up scratches on unfinished surfaces to restore corrosion resistance.

D. Touch up scratches on finished surfaces to restore finish.

3.6 COMMISSIONING

A. Operate equipment controls and safeties.

B. Lubricate rotating parts.

C. Verify fan rotation direction.

D. Verify that motor amperage complies with manufacturer's data.

E. Adjust water level control for proper operating level.

END OF SECTION

SECTION 26 0500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 HEIGHT OF BOXES

A. Outlet mounting heights as indicated on the plans are approximate for bidding purposes only. The exact mounting height (and locations) of outlets shall be determined in the field with relation to architectural detail and equipment being served. It shall be the responsibility of the electrical contractor to coordinate outlet location with equipment, with furniture plans and with architectural elevation plans. Where mounting heights are not detailed or dimensioned, contact the owner's representative for direction.

B. Prior to rough-in, coordinate final mounting heights of all system outlet boxes in field with Owner's representative. Height of boxes dimensioned from ceiling as given above apply to rooms having ceiling 9' or less. In rooms having higher ceilings, these outlets shall be located as directed in the field. Height of boxes from finished floor to center of boxes shall be as follows, unless directed otherwise in field or otherwise noted on electrical plans or architectural plans.

1. Switches
   a. Counter - 3'-8" (verify and match counter receptacle heights)
   b. Elsewhere - 4'-0"

2. Receptacles
   a. Counters - 3'-8" (verify)
   b. Elsewhere - 1'-6" to bottom of box

3. Telephone Outlets/Data Outlets
   a. Desk Phone - 1'-6"
   b. Wall Phone - 4'-0"

4. Starters - 4'-0"
5. Disconnects - 4'-0"
6. Circuit Breaker Panelboards - 6'-0" to top of panel
7. Wall Mounted Light Fixtures - As noted on plans or as directed by Architect
8. Clock Outlets - 1'-0" below ceiling to top of clock (verify)
9. Television Outlets (MATV/CATV) - 1'-6"
10. Desktop/Tabletop/Portable Sets - 1'-6"
11. Wall/Ceiling Bracket Sets - 1'0"
12. Occupancy Sensors
    a. Wallbox Switches - 4'0"
    b. Others - See Mfg. Literature
13. Other Outlets/Fixtures/Equipment - As Directed by Architect

1.2 ACCESS DOORS

A. Access doors shall not be used unless special prior written permission is granted from the Owner's representative. All pull boxes, junction boxes, etc. shall be installed in areas which are readily accessible after completion of construction. Pull boxes and junction boxes shall

not be installed above gypsum board or similar ceiling systems. Where there is no other recourse but to provide and access door/panel and where approval of Owner's representative has been obtained, provide all required access door/panels as required for a complete code-compliant electrical installation as defined below.

B. For installation in masonry, concrete, ceramic tile, or wood paneling provide 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors. For gypsum wallboard or plaster provide perforated flanges with wallboard bead. For full-bed plaster applications provide galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Set frames accurately in position and securely attached to supports, with face panels plum and level in relation to adjacent finish surfaces. Adjust hardware and panels after installation for proper operation. Locking devices shall be flush, screwdriver-operated cam locks.

D. Provide factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces. Frames shall be 16-guage, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling. Standard Flush Panel Doors shall be 14-guage steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory applied prime paint. Fire-Rated Units shall be insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

E. Subject to compliance with requirements, provide products by one of the following:

1. Bar-Co., Inc.
2. J.L. Industries
3. Karp Associates, Inc.
4. Milcor Div. Inryco, Inc.
5. Nystrom, Inc.

1.3 ELECTRICAL INSTALLATIONS

A. All electrical work installed in finished areas shall be concealed. All electrical work installed in unfinished areas may be exposed at the discretion of the Owner's representative. Where exposed conduit and boxes are installed in areas which are already finished, such work shall be painted by the electrical contractor to match adjacent surfaces as directed in field.

B. Arrange for chases, slots, and openings in other building components during the progress of construction, to allow for electrical installations. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the work.

C. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible.

D. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and architectural/structural components.

E. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.

F. Install systems, materials and equipment giving right-of-way priority to systems required to be installed a specified slope.

G. Project the structure, furnishings, and adjacent materials not indicated or scheduled to be removed.

H. Verify all dimensions by field measurements. Take measurements and be responsible for exact size and locations of all openings required for the installation of work. Figured dimensions are reasonably accurate and should govern in setting out work. Where detailed method of installation is not indicated or where variations exist between described work and approved practice, direction of the owner's representative on job shall be followed. Where applicable, remove and/or relocated any existing electrical work conflicting with new construction.

I. Branch circuits shall be installed as shown on the plans. The symbols used to indicate the purpose of which the various outlets are intended are identified in the legend. Where outlets are indicated by letters on plans, they shall be controlled by corresponding switches.

J. No wire size smaller than No. 12 shall be used for any branch circuit unless otherwise noted on plans for control circuits. Larger sizes shall be used where required and/or indicated on the plans. Minimum conduit size shall be 3/4".

K. Device or fixture outlets shall not be installed directly back to back, where located on opposite sides of common walls. Outlets shall be offset by at least two feet.

L. All wires shall be run continuous from outlet to outlet and all joints shall be properly spliced. Insulation value of joints shall be 100% in excess of that of the wire. Mechanical wire splicers may be used. Friction and rubber tape shall conform to Federal Specifications HH-T-11 and HH-T-111. Plastic electrical tape shall be Scotch #33 or approved equal. The conductors terminating at each wired outlet shall be left not less than 6" long at their outlet fittings to facilitate installment of devices of fixtures.

M. If during construction it becomes apparent that certain minor changes in layout will effect a neater job or better arrangement, such alterations shall be made a part of the contract. Engineer's review shall be obtained before making such changes.

N. Workmanship throughout shall conform to the standards of best practice. Marks, dents or finish scratches will not be permitted on any exposed materials, fixtures or fittings. Inside of panels and equipments boxes shall be left clean.

1.4 COORDINATION

A. Coordination shall commence immediately upon award of contract. Failure of this contractor in coordinating (including providing related information to other trades for review) in a timely manner, shall not result in any subsequent additional reimbursement, special allowances or additional construction time being made for any facet of the project. Any work

fabricated or installed before properly coordinating with all other trades will be done at this contractor's risk.

B. Plans are diagrammatic indicating design intent and indicating required size, points of termination and, in some cases, suggested routes, all necessary offsets, etc. All ductwork, piping, conduit, raceways, cable assemblies, etc. shall be run as straight as possible and symmetrical (perpendicular to or parallel with) architectural items. Work installed diagonal to building members shall not be permitted. The contract document drawings are an outline to indicate the approximate location and arrangement of ductwork, piping, equipment, outlets, raceways, cables, etc.

C. The electrical contractor shall work in harmony with all building contractors and sub-contractors, so as not to cause any delays in pouring concrete, building masonry wall, etc. The location of risers and branch conduits are approximate, but owing to the lack of space in some instances, all trades must work in harmony to insure space and satisfactory arrangement for all work to be installed under this contract. The electrical contractor shall consult the Architectural, Plumbing, HVAC and Structural plans in all instances before installing electrical work so that electrical work will not interfere with those branches.

D. This contractor shall participate in coordination efforts and in preparation of coordination drawings prior to fabrication or installation of any equipment, materials, etc. Coordinate actual clearances of all installed equipment. Exact location of electrical outlets, lighting fixtures, conduits, raceways, equipment, cable assemblies, applicable devices, etc. and of mechanical equipment, piping, ducts, fixtures, diffusers, grills, louvers, dampers, etc., shall be coordinated well in advance by all affected contractors so there will be no interferences at installation between the various trades. Ensure that work of all trades, as well as working clearances, in electrical rooms or spaces complies with NEC Article 110.

E. Conflicts in equipment and materials shall be corrected prior to installation. Should there be a conflict with drawings of other trades, this contractor shall work with the trades to correct the conflict while coordinating representative for a final decision as to method of material. Any work installed or equipment placed in position by this contractor creating a conflict shall be readjusted to the satisfaction of the owner's representative at the expense on this contractor.

1.5 IDENTIFICATION

A. General

1. Submit manufacturer's data on electrical identification materials and products. Submit detailed nameplate schedule indicating proposed nomenclature, colors, text heights, fastening methods, etc. If requested by Owner's representative, submit samples of each color, lettering style and other graphic representations required for each identification material or system.
2. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application. Where identification is to be applied to surfaces which require finish, install identification after completion of painting. Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Cable and Conductor Identification

1. Provide manufacturer's standard vinyl-cloth self-adhesive conductor markers of wrap-around type, either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification. Provide on all conductors of all systems. All conductors of all systems shall have color coded insulation. All cables of all systems shall have color coded jackets. Match color schemes with marking systems used in existing systems (where applicable), shop drawings, contract documents, and similar previously established identification of project's electrical work. Apply cable/conductor identification of each cable in each box/enclosure/cabinet for cables which are not available with color coded insulation or jackets.
2. The following insulation color code shall be used for power systems and voltage identification. This shall apply to both feeder and branch circuit wiring. Interchange of colors shall no be permitted. The use of scotch color coding tapes for phase identification is not permitted. Branch circuit and feeder conductor insulation shall be color coded throughout entire length.

   a. 208/120V system - Black, Red, Blue and White
   b. Equipment Grounding - Green

3. Engraved Plastic-Laminate Signs

   a. Install signs at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with stainless steel fasteners, except use permanent adhesive where fasteners should not or cannot penetrate substrate.
   b. All equipment and systems identification nomenclature shown on drawings or listed herein is shown for general design and installation reference only. The actual nameplate, etc. nomenclature for the project shall be verified by electrical contractor in field prior to fabrication and where applicable, shall be an extension of existing nomenclature used on the site as determined in field by electrical contractor. Record documents shall be prepared accordingly. Unless determined otherwise in field, provide text matching terminology and numbering of the contract documents and shop drawings.
   c. Unless directed otherwise, provide black face and white core plies (letter color) for normal power applications and red face and white core piles (letter color) for emergency power applications, punched for mechanical fastening except where adhesive mounting is mandatory because of substrate. For healthcare facilities, non-essential equipment shall have black face and white core plies, essential shall have orange face and white core, and critical shall have red face and white core. Provide 1/2" minimum text height for all equipment identification and 1/4" minimum text height for all nameplates with narrative descriptions/instructions. Thickness shall be 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units. As a minimum provide signs for each unit of the following categories of electrical work where such work exists on the project.

      1) Electrical access panel doors.
      2) Starters, disconnects, contactors and control stations.

3) Panelboards, electrical cabinets and enclosures.
4) Control panels for all systems.
5) Electrical switchboards and switchgear (include company name of engineer and installing contractor at all service entrance switchboards).
6) Switch wall plates (via engraving) for all switches that control remote lights of loads.
7) Other similar equipment designated by owner's representative or engineer in field.

1.6 CUTTING, PATCHING AND SEALING

A. General

1. The electrical contractor shall provide all cutting as required for the admission of electrical work unless directed otherwise in field, all related patching and painting (to match surrounding methods, materials and colors) shall be provided by the electrical contractor. Any damage done by this contractor's expense. Perform cutting, fitting, and patching for electrical equipment and materials as required to:

    a. Uncover work to provide for installation of ill-timed work.
    b. Remove and replace defective work.
    c. Remove and replace work not conforming to requirements of the Contract Documents.
    d. Remove samples of installed Work as specified for testing.
    e. Install equipment and materials in existing structures.

2. Upon Written instructions from the owner's representative, uncover and restore work to provide for observation of concealed work by owner's representative or by inspection authority having jurisdiction.
3. During cutting and patching operations, protect adjacent installation (structure, finishes, furnishings, etc.). Where applicable, provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to system components and components of other trades.
4. Patch surfaces and building components using new materials matching existing materials and using experienced Installers. Refer to Division 1 for definition of experiences "Installer" or determine qualifications as directed in field by owner's representative.
5. Patching through fire rated walls and enclosures shall not diminish the rating of that wall or enclosure. All materials used for patching shall be installed to meet or exceed the smoke and fire rating of the respective surface being patched.
6. Neatly cut and drill all openings in walls and floors required for the installation. Secure approval of Owner's Representative before cutting and drilling in existing facilities. Neatly patch all openings cut.
7. Cutting and patching shall be held to a minimum by arranging with other contractors for all sleeves and openings before construction is started.

END OF SECTION 26 0500

SECTION 26 0519 - LOW-VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

B. Install all wire in raceway unless specifically permitted otherwise hereafter in this section under other Division 26 sections or on electrical drawings.

1.2 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Wires and Cables:

1. Alcan Aluminum Corporation; Alcan Cable Div.
2. American Insulated Wire Corp.; Leviton Manufacturing Co.
3. BICC Brand-Rex Company.
4. Carol Cable Co., Inc.
5. Senator Wire & Cable Company.
6. Southwire Company.

C. Connectors for Wires and Cables:

1. AMP Incorporated.
2. General Signal; O-Z/Gedney Unit.
3. Monogram Co.; AFC.
4. Square D Co.; Anderson.
5. 3M Company; Electrical Products Division.

2.2 GENERAL

A. Provide wire and cable suitable for the temperature, conditions and location where installed.

2.3 CONDUCTORS

A. Conductor material shall be copper for all wires and cables. Conductor sizes indicated are based on copper. Minimum conductor size shall be #12 AWG. Provide stranded conductors for all sizes unless indicated otherwise.

B. Distances from panel to first outlet of a 15 or 20 amp branch circuit shall require the following minimum wire size to the first outlet. All branch circuits more than 100 feet in length shall be minimum No. 10 to the last outlet. Control circuits shall be No. 14 except for runs exceeding 300 feet where they shall be No. 12.

(1) Distance	AWG Wire Sizes
(2) Up to 100 feet	#12
(3) 100 to 200 feet	#10
(4) More than 200 feet	#8

C. Color Coding for phase identification shall be in accordance with Division 26 Section "Common Work Results for Electrical." All conductor insulation shall be rated at 600V AC/ 90 deg. Provide XHHW-2 insulation for all conductors size 250 kcmil (MCM) and larger. For all other sizes provide THW or THHN/THWN-2 insulation as appropriate for the locations where installed.

D. Provide XHHW-2 insulation for all wiring below grade and/or for all wiring subject to moisture conditions.

E. Provide dedicated parity sized neutral conductor for each branch circuit phase conductor that serves H.I.D. luminaires.

F. Provide dedicated parity sized neutral conductor for each branch circuit phase conductor that serves receptacles.

2.4 TYPE AC/MC CABLES

A. Type AC cable is not permitted for use on this project.

B. Type MC Cables shall be 90 deg. C. rated with all components and fittings listed for grounding and compliant with the following.

1. UL Std. 4 and UL Std. 83.
2. ANSI E119 and E814.
3. NEC Articles 250 and 333.

C. Cables shall be formed from continuous length of spirally wound, interlocked zinc-coated or glavanized (inside & outside) strip steel. All conductors shall be rated for 90 deg. C. minimum. Provide with full size parity sized green insulated equipment ground condutor.

D. Provide compatible steel fittings with integral red plastic insulated throat bushings, compliant with NEC 350-5.

E. Type MC cable may be utilized only if NEC approved and if approved by local authority having jurisdiction and in the following applications defined below.

1. Final connection to lighting fixtures that are installed in accessible tile ceiling systems.
2. Wiring from fixture to fixture only above accessible ceilings.
3. Behind drywall walls for connection of receptacles.

F. Type MC cable may not be used behind drywall ceilings which are considered inaccessible.

G. MC cable installed in both locations permitted by this section and areas subject to Article 517 requirements, health facilities type MC must be used.

2.5 PORTABLE CORD (if required)

A. Portable Cord shall be Type S. Provide with full parity sized insulated equipment ground conductor.

B. Type S Portable Cord may be used for flexible pendant leads to outlets and equipment where indicated and only where NEC approved, where approved by local authority having jurisdiction and where prior approval is given by Engineer.

2.6 CONNECTORS FOR CONDUCTORS

A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Wires #6 AWG and larger shall be connected to panels and apparatus by means of approved lugs or connectors large enough to enclose all strands of the conductors. Connectors shall be of the solderless type. Solderless connectors shall be O.Z. Type XW or XTP of proper size and type required with Bakelite covers and stainless steel spring clips. Solderless lugs shall be O.Z. Type XL of proper size as required.

C. No wire shall be pulled until raceways are complete, plastering is complete and raceways are free of moisture. Joints or splices shall be permitted only at NEC approved panels, junction boxes or accessible outlet boxes. Pull conductors simultaneously where mor e than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary. Use pulling means including, fish tape, cable, rope or basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable. Conceal all work in finished spaces.

D. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."

E. Remove existing wires from raceway before pulling in new wires and cables.

F. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

G. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

H. Support cables according to Division 26 Section "Common Work Results for Electrical."

I. Seal around cables penetrating fire-rated elements according to Division 7 Section "Firestopping."

J. Identify wires and cables according to Division 26 Section "Common Work Results for Electrical."

3.2 FIELD QUALITY CONTROL

A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
2. Megger all branch circuits and feeders #6 and larger. Submit results to consulting engineer. Acceptable meg ohm readings shall be per NETA standards.

B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 26 Section 0519 "Low-Voltage Electrical Power Conductors and Cables" for requirements for grounding conductors.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.

1.3 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Erico Inc.; Electrical Products Group.
2. Galvan Industries, Inc.
3. Ideal Industries, Inc.
4. ILSCO.
5. O-Z/Gedney Co.
6. Raco, Inc.
7. Thomas & Betts, Electrical.

2.2 GROUNDING AND BONDING PRODUCTS

A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE AND CABLE GROUNDING CONDUCTORS

A. Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

1. Material: Copper. Use only copper wire for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. Equipment Grounding Conductors: Insulated with green color insulation.

C. Grounding-Electrode Conductors: Stranded cable.

D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.

E. Bare Copper Conductors: Conform to the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.4 MISCELLANEOUS CONDUCTORS

A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.

B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Bonding Straps: Soft copper, 0.05 inch (1 mm) thick and 2 inches (50 mm) wide, except as indicated.

2.5 CONNECTOR PRODUCTS

A. Pressure Connectors: High-conductivity-plated units.

B. Bolted Clamps: Heavy-duty type.

C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.6 GROUNDING ELECTRODES

A. Grounding Rods: Sectional type; copper-clad steel.

1. Size: 3/4 inch by 120 inches (19 by 3000 mm).

PART 3 - EXECUTION

3.1 APPLICATION

A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:

a. Feeders and branch circuits.
b. Lighting circuits.
c. Receptacle circuits.
d. Single-phase motor or appliance branch circuits.
e. Three-phase motor or appliance branch circuits.
f. Flexible raceway runs.
g. Metal-clad cable runs.

2. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

B. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide a No. 4 AWG minimum insulated grounding conductor in raceway from grounding-electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

C. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-26.

3.2 INSTALLATION

A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.

B. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.

1. Drive until tops are 2 inches (50 mm) below finished floor or final grade, except as otherwise indicated.

2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.

C. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches (600 mm) below grade.

E. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.

F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.

G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

3.3 CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and grounding rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 ADJUSTING AND CLEANING

A. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Conduit and equipment supports.

B. Fastening hardware.

1.2 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, they carry.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Support Channel: Galvanized steel.

B. Hardware: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, beam clamps, spring steel clips.

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in metal studs; and wood screws in wood construction.

C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

D. Do not use powder-actuated anchors.

E. Do not drill structural steel members.

F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance.

1. Use hexagon head bolts with spring lock washers under all nuts.

G. Install freestanding electrical equipment such as switchboards, motor control centers, and transformers on a housekeeping pad, minimum 4" thick and 4" overhang.

H. Install surface-mounted cabinets and panel boards with minimum of four anchors.

1. Provide steel channel supports to stand cabinet 3/4" off wall.

I. Bridge studs top and bottom with channels to support flush-mounted cabinets and panel boards in stud walls.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:

a. RMC.
b. IMC.
c. EMT.
d. FMC.
e. LFMC.
f. RNC. (PVC)
g. Wireways.
h. Surface raceways.

2. Boxes, enclosures, and cabinets include the following:

a. Device boxes.
b. Outlet boxes.
c. Pull and junction boxes.

B. Related Sections include the following:

1. Division 26 Section 0500 "Common Work Results for Electrical" for raceways and box supports.
2. Division 26 Section 2726 "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RMC: Rigid metal conduit.

F. RNC: Rigid nonmetallic conduit. (PVC)

1.3 SUBMITTALS

A. Product Data: For raceways, fittings, boxes, and enclosures to be used.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

B. Comply with NECA's "Standard of Installation."

1.5 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Conduit and Tubing:

a. Carol Cable Co., Inc.
b. Cole-Flex Corp.
c. Grinnell Co.; Allied Tube and Conduit Div.
d. Monogram Co.; AFC.
e. Triangle PWC, Inc.
f. Wheatland Tube Co.

2. Nonmetallic Conduit and Tubing:

a. Cantex Industries; Harsco Corp.
b. Hubbell, Inc.; Raco, Inc.
c. Lamson & Sessions; Carlon Electrical Products.
d. Thomas & Betts Corp.

3. Conduit Bodies and Fittings:

a. American Electric; Construction Materials Group.
b. Crouse-Hinds; Div. of Cooper Industries.
c. Emerson Electric Co.; Appleton Electric Co.
d. Hubbell, Inc.; Killark Electric Manufacturing Co.
e. Lamson & Sessions; Carlon Electrical Products.
f. O-Z/Gedney; Unit of General Signal.

4. Metal Wireways:

a. Hoffman Engineering Co.
b. Square D Co.

5. Surface Metal Raceways:

a. American Electric; Construction Materials Group.
b. Butler Manufacturing Co.; Walker Division.
c. Wiremold Co. (The); Electrical Sales Division.

6. Surface Nonmetallic Raceways:

a. Butler Manufacturing Co.; Walker Division.
b. Hubbell, Inc.; Wiring Device Division.
c. Lamson & Sessions; Carlon Electrical Products.
d. Panduit Corp.
e. Wiremold Co. (The); Electrical Sales Division.

7. Boxes, Enclosures, and Cabinets:

a. American Electric; FL Industries.
b. Butler Manufacturing Co.; Walker Division.
c. Crouse-Hinds; Div. of Cooper Industries.
d. Electric Panelboard Co., Inc.
e. Erickson Electrical Equipment Co.
f. Hoffman Engineering Co.; Federal-Hoffman, Inc.
g. Hubbell Inc.; Killark Electric Manufacturing Co.
h. Hubbell Inc.; Raco, Inc.
i. Lamson & Sessions; Carlon Electrical Products.
j. O-Z/Gedney; Unit of General Signal.
k. Parker Electrical Manufacturing Co.
l. Robroy Industries, Inc.; Electrical Division.
m. Thomas & Betts Corp.
n. Woodhead Industries, Inc.; Daniel Woodhead Co.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Outdoors: Use the following wiring methods:

1. Exposed: IMC.
2. Underground: RNC(PVC Schedule 40) or IMC.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Indoors: Use the following wiring methods:

1. Exposed: EMT.
2. Concealed: EMT or MC (for receptacles)
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
4. Damp or Wet Locations: IMC.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

   a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
   b. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.

6. Connection to light fixtures: Type MC Cable may be used where permitted by code and in lengths no greater than 8'-0" (243 CM) above accessible ceilings.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Minimum Raceway Size: 3/4-inch trade size (DN21).

C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Install raceways level and square and at proper elevations. Provide adequate headroom.

F. Complete raceway installation before starting conductor installation.

G. Support raceways as specified in Division 26 Section "Common Work Results for Electrical."

H. Use temporary closures to prevent foreign matter from entering raceways.

I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

O. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

P. Tighten set screws of threadless fittings with suitable tools.

Q. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

S. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

T. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

U. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

V. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

W. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

X. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in a nonmetallic sleeve.

Y. Do not install aluminum conduits embedded in or in contact with concrete.

Z. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
2. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.
4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 26 0533

SECTION 26 0536 - PATHWAYS FOR ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Pathways for Telecommunications Systems.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store indoors. Unpack and dry wet materials before storage.

1.5 DEFINITIONS

A. Pathways: Structures or hardware that provides a permanent and reusable route for housing and the protection of cable media installed between two end points. These structures also provide a permanent enclosure or mechanism that facilitates the addition or replacement of cable over time.

B. Intrabuilding: For horizontal or vertical routing of cable, intrabuilding pathways shall include conduit. Horizontal support hardware is further defined as continuous, (e.g. Conduit) and non-continuous (e.g. J-Hooks, Bridle Rings).

PART 2 - PRODUCTS – NOT USED

PART 3 – EXECUTION

3.1 TELECOM PATHWAYS INSTALLATION

A. Conduit shall be used in locations where access to cable is unavailable, where portions of the pathway span are inaccessible (i.e. embedded in walls, hard ceilings).

B. Conduits shall not have more than 180 degrees of bends or turns in a segment without the installation of a pullbox.

C. Communication Conduits' fill limitations shall be based on the anticipated cable load, following the fill ratio calculations provided in ANSI/TIA/EIA/569A and the NEC.

D. For hard pan ceiling installation, conduits shall be run continuous from the outlet box to the accessible ceiling where necessary to meet bend radius requirements. They are to be connected to double-gang, deep device boxes (2 1/8 "box with a 1" mud ring), equipped with a single-gang drywall ring at the outlet location.

E. Conduits to Surface Mounted Raceways (SMR) shall be sized to equal the capacity of the SMR channel or cabling capacity. The raceway size of the SMR must be designed to meet the size and number of cables to be installed and include space for the installation of communication outlets. Individual workstation conduits are to be dedicated to only one outlet box each, and shall not be "daisy-chained" together.

F. For drop ceiling installation, conduits should be run continuous from the outlet box to 6 in. above wall with a 90 degree bend, with plastic protective ring. J-Hooks, with the size and number of cables, should be installed at maximum of 3 ft. intervals to support cable to main pathways. They are to be connected to double-gang, deep device boxes (2 1/8 "box with a 1" mud ring), equipped with a single-gang drywall ring at the outlet location. Individual workstation conduits are to be dedicated to only one outlet box each, and shall not be "daisy-chained" together.

G. Surface Mounted Raceways (SMR) shall be sized to equal the capacity of the SMR channel or cabling capacity. The raceway size of the SMR must be designed to meet the size and number of cables to be installed and include space for the installation of communication outlets, with appropriate double-gang, deep device boxes (2 1/8 "box). J-Hooks, with the size and number of cables, should be installed at maximum of 3 ft. intervals to support cable to main pathway.

H. A Pull Box is required each 100 feet, and/or after 180 degrees of directional change has been affected.

I. Non-Continuous Horizontal Cable Support Hardware shall be used in locations where the communication cable is not supported by continuous systems such as cable trays or conduit. Non-Continuous Cable Supports shall be placed not more than 3 feet apart in linear runs.

J. J-Saddle Hooks shall be supported by threaded rod, beam clamps, screwed to existing studding, etc., and can be "ganged" together to provide a number of support way points along a cable route.

K. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables (CAT 6 Augmented); UL Listed. Non-continuous cable supports shall have flared edges to prevent damage while installing cables. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments. Non-continuous cable supports shall be ERICO CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CMTM Double J-Hook CAT100CM; CAT-CMTM U-hook series CAT200CMLN, CAT300CMLN; and CAT-CMTM retainer CATRT200CM, CATRT300CM or approved equal.

END OF SECTION 26 0536

SECTION 26 0548 - VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

B. Related Sections include the following:

1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Welding certificates.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Comply with NFPA 70.

PART 2 – PRODUCTS

2.1 VIBRATION ISOLATORS

A. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

B. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

C. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation devices to indicate capacity range.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 0548

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Power Raceway Identification Materials
2. Armored & Metal-Clad Identification Materials
3. Power & Control Cable Identification
4. Warning Labels and Signs
5. Instruction Signs

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design this project element, including comprehensive engineering analysis by a qualified design professional, to meet or exceed the program requirements, performance requirements, code compliance, applicable ASTM quality standard, and design criteria as outlined and / or referenced within this RFP package.

1.4 SUBMITTALS

A. Not used.

1.5 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, all where applicable, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type, panel and circuit numbers.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer, or
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type, panel and circuit numbers.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label, or

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner to engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in compliance with CO-7 DB section 16.

END OF SECTION 26 0553

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of lighting controls:

1. Photoelectric relays.
2. Occupancy sensors.
3. Lighting relays and contactors.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for lighting control equipment and systems components, including dimensions and data on features and components. Include wiring diagrams and elevation views of front panels of control and indicating devices. Include data on ratings. For flush control panels, submit color and finish options for selection.

C. Shop Drawings detailing assemblies of standard components, custom assembled for specific application on Project. Indicate dimensions, weights, arrangement of components, and clearance and access requirements.

D. Maintenance data for lighting control equipment and systems components to include in the operation and maintenance manual specified in Division 1.

1.3 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

1.4 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactors and Relays:

a. Siemens Energy and Automation, Inc.
b. Square D Co.
c. Cutler Hammer

2. Time Switches:

a. Intermatic, Inc.
b. Paragon Electric Co., Inc.
c. Tork, Inc.

3. Photoelectric Relays:

a. Allen-Bradley Co, Inc.; Industrial Control Group Div.
b. Intermatic, Inc.
c. Paragon Electric Co, Inc.
d. Tork, Inc.

4. Occupancy Sensors:

a. Watt Stopper (only)

2.2 CONTACTORS AND RELAYS

A. Description: Devices are electrically operated and mechanically held. Number of poles and ratings are as indicated. Coordinate rating of each unit with type of load served, including tungsten filament and inductive-type loads.

B. Modular Single-Pole Relays: Split-coil, momentary-pulsed type, knockout mounting.

1. Low-Voltage Leads: 5-pin plug connector.
2. Pilot Contacts: Single pole.
3. Rated Capacity: 20 A, 125 VAC for tungsten filaments, and 20 A, 277 VAC for ballasts.
4. Endurance: 50,000 cycles at rated capacity.

2.3 TIME CLOCKS

A. Time Clock: Solid-state programmable units with alphanumeric display conforming to UL 917. Include the following features:

1. Provide Paragon EL71 suntracker type or equal. Voltage of unit shall be rated for specific equipment or device being controlled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment according to manufacturers' written instructions.

B. Mount control equipment according to manufacturers' instructions and Division 26 Section "Common Work Results for Electrical."

C. Mounting heights indicated are to bottom of unit for suspended items and to center of unit for wall-mounted ones.

3.2 CONTROL WIRING INSTALLATION

A. Install wiring between control devices as specified in Division 26 Sections "Low-Voltage Electrical Power Conductors and Cables " for low-voltage connections, and "Voice and Data Systems" for digital circuits.

B. Wiring Method: Install all wiring in raceway as specified in Division 26 Section "Raceways and Boxes for Electrical Systems" except where run in accessible ceiling space, and gypsum board partitions.

D. Bundle, train, and support wiring in enclosures.

E. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section " Common Work Results for Electrical."

3.4 FIELD QUALITY CONTROL

A. Visual and Operational Inspections: Include the following inspections:

1. Inspect control components for defects and physical damage, NRTL labeling, and nameplate compliance with current Project Drawings.
2. Check tightness of electrical connections with torque wrench calibrated within previous 6 months. Use manufacturer's recommended torque values.
3. Verify settings of photoelectric devices with photometer calibrated to National Institute for Science and Technology (NIST) standards within past 6 months.
4. Exercise and perform operational tests on mechanical parts and operable devices according to manufacturer's instructions for routine functional operation.

B. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following tests according to manufacturer's instructions:

1. Continuity tests of circuits.
2. Operational Tests: Set and operate controls to demonstrate controls in a methodical sequence that cues and reproduces actual operating functions. Include testing of dimming equipment and ambient-light, programmable, and occupancy controls under

conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

C. Correct deficiencies disclosed by inspections and tests, make necessary adjustments, and retest deficient items. Verify that specified requirements are met.

3.5 ADJUSTING AND CLEANING

A. Occupancy Adjustments: Upon request within 1 year of date of Substantial Completion, make up to 1 on-site visits to Project site to assist in adjusting light levels, making program changes, and adjusting sensors and controls.

B. Repair scratches and mars of finish to match original finish. Clean equipment and devices internally and externally using methods and materials recommended by manufacturers.

END OF SECTION 26 0923

SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V and less.

B. Related Sections include the following:

1. Division 26 Section "Common Work Results for Electrical" for general materials and installation methods.

1.2 SUBMITTALS

A. Product Data: For each type of panelboard, accessory item, and component specified.

B. Shop Drawings: For panelboards. Include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

1. Enclosure type with details for types other than NEMA 250, Type 1.
2. Bus configuration and current ratings.
3. Short-circuit current rating of panelboard.
4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
5. Wiring Diagrams: Details of schematic diagram including control wiring and differentiating between manufacturer-installed and field-installed wiring.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

D. Maintenance Data: For panelboard components to include in the maintenance manuals specified in Division 1. Include manufacturer's written instructions for testing circuit breakers.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

1.5 EXTRA MATERIALS

A. Keys: 6 spares of each type for panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Eaton Corp.; Westinghouse & Cutler-Hammer Products.
2. Siemens Energy & Automation, Inc.
3. Square D Co.

2.2 PANELBOARD FABRICATION

A. Enclosures: Flush- or surface-mounted cabinets as indicated. NEMA Type 1, unless otherwise indicated to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA Type 3R.
2. Kitchen Areas: NEMA Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA Type 4.

B. Front: Secured to box with concealed trim clamps, unless otherwise indicated. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box, unless otherwise indicated.

C. Directory Frame: Metal, mounted inside each panelboard door.

D. Bus: Hard drawn copper of 98 percent conductivity.

E. Main and Neutral Lugs: Compression type.

F. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.

G. Service Equipment Approval: If panel shown on drawings is shown to be used for Service Entrance, provide panel listed for use as service.

H. Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.

I. Feed-through Lugs: If single-line diagram and/or panel schedules indicate feed through lugs, size lugs to accommodate feeders indicated.

2.3 LOAD CENTERS

A. Not permitted to be used.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

2.5 DISTRIBUTION PANELBOARDS

A. Doors: In panelboard front, except omit in fusible-switch panelboard, unless otherwise indicated. Secure door with vault-type latch with tumbler lock, all keyed alike.

B. Branch-Circuit Breakers: Where overcurrent protective devices are indicated to be circuit breakers, use bolt-on circuit breakers, except circuit breakers 225-A frame size and greater may be plug-in type where individual positive-locking device requires mechanical release for removal.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 1, handle lockable.

1. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
2. Application Listing: Appropriate for application, including Type SWD for switching fluorescent lighting loads and Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
4. Circuit Breakers, 400 A and Larger: Field-adjustable LSI current settings.
5. Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.
6. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
7. Shunt Trip: Where indicated.

B. Circuit breakers for emergency systems shall be selectively coordinated as required by NEC 700.27. Contractor shall submit to engineer coordination study from vendor to obtain approval of overcurrent device prior to ordering,

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessory items according to NEMA PB 1.1.

B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.

D. Circuit Directory: Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing.

E. Install filler plates in unused spaces.

F. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space

in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

G. All panelboards shall be minimum 54 space regardless of what is shown on the drawing panel schedules.

H. Wiring in Panelboard Gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.

I. Contractor shall be responsible for coordinating installation of panelboards with general contractor. Electrical Contractor shall verify all walls which shall receive panelboards and make sure that walls are minimum 6" deep to accommodate panels. If walls are not able to accommodate depth Electrical Contractor shall relocate panel to walls which are satisfactory to receive 6" depth. No additional compensation will take place for coordination of panel depth and relocation to appropriate walls.

J. Contractor shall verify prior to bidding that Loadcenter type construction is suitable for this project. Base bid shall include Panelboard type construction only unless specifically permitted by the Owner.

3.2 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs as specified in Division 26 Section " Common Work Results for Electrical."

B. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.

3.3 GROUNDING

A. Make equipment grounding connections for panelboards as indicated.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.
2. Make continuity tests of each circuit.

B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

C. Balancing Loads: After Substantial Completion, but not more than 2 months after Final Acceptance, conduct load-balancing measurements and make circuit changes as follows:

1. Perform measurements during period of normal working load as advised by Owner.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 26 2416

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes various types of receptacles, connectors, switches, and finish plates. Verify color selection with Owner's representative.

1.2 SUBMITTALS

A. Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

1. Product data for each product specified.

B. Operation and maintenance data for materials and products specified in this Section to include in the "Operating and Maintenance Manual" specified in Division 1.

1.3 QUALITY ASSURANCE

A. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.

1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Switches: Leviton & Hubbell
2. Dimmers: Lutron
3. Occupany Sensor: Watt Stopper
4. Receptacles: Leviton & Hubbell
5. Wall Plates: Leviton & Hubbell
6. Multi-Outlet Assemblies: Wiremold.

2.2 SWITCHES

A. Wall Switches

1. Wall switches, in general shall be flush self-grounding with green ground screw and color coded cover, toggle type, back & side wired, specification grade, rated 20A, 120/277 volts, 1 HP at 120V, A.C quiet type. Locking type switches shall be same as below except with "L" suffix (provide six keys). Catalog numbers below are based on Leviton.

a) Single pole, toggle: CSB1-20G
b) Double-pole, toggle: CSB2-20G
c) 3-way, toggle: CSB3-20G
d) 4-way, toggle: CSB4-20G
e) Double Pole, key lock: 1222-2KL

B. Occupancy Sensor Switches

1. Occupancy sensor lighting swiches for individaul room applications shall be Watt Stopper Inc. #WS-120 or WS-277 series as required. Install these sensors at standard switch heights and locations.
2. Occupancy sensor lighting switches for special applications shall be per the Electrical Legned on the drawings, with power packs, accessories, lenses, mounting, wiring and installation methods as recommended by manufacturer for a complete working installation.

2.3 RECEPTACLES

A. Standard Specification Grade Duplex/Single Receptacles

1. Provide duplex and single specification grade receptacles, 2-pole, 3-wire grounding, self-grounding, green grounding screw, ground terminals and poles internally connected to mounting yoke, color coded base, 15-amp and 20-amp, 125-volts, with metal plaster ears, back & side wiring, NEMA configuration 5-15R or 5-20R.
2. Duplex receptacles shall be as listed below.

a) Duplex Receptacle: CR15-GY, CR20-GY
   a. Color: Gray
b) Tamper Resistant: 8200-SGG
   a. Color: Gray
c) Receptacles wired on emergency power shall be red.

B. Ground-Fault Interrupter Specification Grade Receptacles

1. Provide self grounding commercial specification grade, duplex receptacles, ground-fault circuit interrupters; feed-thru type, capable of protecting connected downstream receptacles on single circuit, grounding type UL-rated 943, Class A, Group 1, specification grade, 20-amperes rating (device & feed-thru), 125-volts, 60 Hz; with solid-state ground-fault sensing and signaling (maximum threshold of 5 mA at .025 seconds maximum); equip with 20-ampere plug configuration, NEMA 5-20R. Design units for installation in a 2-3/4-inch (70-mm) deep outlet box without an adapter.
2. Ground fault circuit interrupter duplex receptacles shall be Leviton # 7599-G series.
3. Where GFI protected receptacles are shown on the drawings, provide a separate GFI receptacle for each one shown. Do not feed downstream receptacles from load-side (GFI-protected) terminals of upstream receptacles.

C. Weatherproof cover for exterior receptacle: Leviton 5977-GY

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

D. Protect devices and assemblies during painting.

E. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit the indicated arrangement of partitions and furnishings.

F. Exterior outlets: All exterior outlets shall be of the Ground-Fault Circuit Interrupter (GFCI) Type whether or not they are indicated as such on the drawings. Exterior outlets shall also be provided with a weatherproof cover that is UL listed.

3.2 GROUNDING

A. Isolated Ground Receptacles: Connect to isolated grounding conductor routed to designated isolated equipment ground terminal of electrical system.

3.3 FIELD QUALITY CONTROL

A. Testing: Test wiring devices for proper polarity and ground continuity.

B. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer recommendations.

C. Replace damaged or defective components.

D. Cord and Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.

E. Cord: Rubber-insulated, stranded copper conductors, with type SOW-A jacket. Grounding conductor has green insulation. Ampacity is equipment rating plus 30 percent minimum.

F. Dimmers:

1. Wattage rating exceeds connected load by 30 percent minimum, except as otherwise indicated.
2. Control: Continuously adjustable slide. Single-pole or 3-way switch to suit connections.

3.4 Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:

A. Color: Stainless Steel.

B. Plate-Securing Screws: Metal with heads colored to match plate finish.

C. Material for Unfinished Spaces: Stainless Steel

D. CLEANING

3.5 General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 2726

SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Fuses.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each fuse type specified.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from one source and by a single manufacturer.

B. Comply with NFPA 70 for components and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:

1. Cooper Industries, Inc.; Bussmann Div.
2. Gould Shawmut.
3. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.

B. Contractor is responsible for examining fuse ratings shown on the drawings with actual nameplate requirements on equipment. Install proper fuses according to nameplate data. No additional amounts will be paid for incorrect fuse ratings shown on the plans.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Main Service: Class L, RK1 fast acting.

B. Main Feeders: Class RK1, time delay.

C. Motor Branch Circuits: Class RK5, time delay.

D. Other Branch Circuits: Class RK5, non-time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

3.4 IDENTIFICATION

A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

END OF SECTION 26 2813

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes individually mounted switches and circuit breakers used for the following:

1. Service disconnect switches.
2. Feeder and equipment disconnect switches.
3. Feeder branch-circuit protection.
4. Motor disconnect switches.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 26 Section "Fuses" for fuses in fusible disconnect switches.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for disconnect switches, circuit breakers, and accessories specified in this Section.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer. These devices shall also be the same source as the panelboards.

B. Comply with NFPA 70 for components and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

B. Manufacturers: Subject to compliance with requirements, provide disconnect switches and circuit breakers by one of the following:

1. Fusible Switches:

a. Siemens Energy & Automation, Inc.
b. Square D Co.
c. Cutler Hammer

2. Molded-Case Circuit Breakers:

a. Siemens Energy & Automation, Inc.

b. Square D Co.
c. Cutler Hammer

2.2 DISCONNECT SWITCHES

A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.

B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.

C. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.

1. Outdoor Locations: Type 3R.
2. Kitchen Areas: Type 4X, stainless steel.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Enclosed, Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.

B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting rating to meet available fault current.

C. Application Listing: Appropriate for application, including switching fluorescent lighting loads or heating, air-conditioning, and refrigerating equipment.

D. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.

E. Circuit Breakers, 400 A and Larger: Field-adjustable, LSI current settings.

F. Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.

G. Current Limiters: Where indicated, integral fuse listed for circuit breaker.

H. Molded-Case Switch: Where indicated, molded-case circuit breaker without trip units.

I. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

J. Shunt Trip: Where indicated.

K. Accessories: As indicated.

L. Enclosure: NEMA AB 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.

1. Outdoor Locations: Type 3R.
2. Kitchen Areas: Type 4X, stainless steel.

3. Other Wet or Damp Indoor Locations: Type 4.
4. Hazardous Areas Indicated on Drawings: Type 7C.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.

B. Install disconnect switches and circuit breakers level and plumb.

C. Compare disconnect rating shown on drawing with that required by the actual nameplate data of equipment purchased. Contractor is responsible for installing correct disconnect required by National Electrical Code. No additional compensation will be provided to provide a disconnect which is rated different than what is shown on the drawings.

C. Connect disconnect switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Identify each disconnect switch and circuit breaker according to requirements specified in Division 26 Section "Common Work Results for Electrical."

3.2 FIELD QUALITY CONTROL

A. Testing: After installing disconnect switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION 26 2816

SECTION 26 2913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.
3. Multispeed.

1.2 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed controller.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 – PRODUCTS

2.1 MOTOR STARTERS AND PUSHBUTTONS:

A. For each building utility motor to which the Contractor makes connection and which is not otherwise noted, provide a disconnect switch and magnetic motor starter, separate or in combination as indicated or required. Overload devices must be suitable for protection by a minimum of 15 amp. circuit breaker or fuse. The overload devices in the starters shall be sized to agree with the current rating shown on the motor nameplate.

B. Individual Motor Starters:

1. Individual motor starters shall consist of an integrally mounted, magnetic, full-voltage, non-reversing (FVNR), starter in a heavy-duty type, dead front, sheet steel enclosure, and surface-mounted. Size and number of poles shall be as shown and required by equipment served. All starters shall be constructed and tested in accordance with the latest NEMA standards.
2. Magnetic starter contacts shall be solid silver cadmium oxide alloy, and shall not require any filing, dressing, or cleaning throughout the life of the starter.
3. Operating coils shall be 120 volts, and shall be pressure molded and designed so that accidental exposure to excessive voltage up to 480 volts will not damage the coil. The starter design shall also be such that when a coil fails due to an over-voltage condition, the starter shall definitely open, and shall not freeze in the closed position.
4. All starters shall have manual reset, tripfree overload relays in each phase conductor. Three-phase FVNR starters shall have three overload relays. Single-phase FVNR starters shall have an overload relay in each ungrounded conductor. Overload relays shall not be field-convertible from manual to automatic reset.
5. Provide RUNNING pilot lights for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter, and shall not be wired across the operating coil.
6. Provide starters with HAND-OFF-AUTOMATIC switches (for motors with automatic control), or START-STOP Pushbuttons (for motors with manual controls) as shown or required. Provide for FAST-SLOW speed selection from HVAC control system for all 2-speed starters. All 2-speed starters shall have deceleration relays between FAST and SLOW speeds. Coordinate motor starter controls with the requirements of this Division 15. Motor starter controls shall be mounted in the starter enclosure cover.
7. A single-phase control power transformer shall be included integrally with each starter for 120 or 24 volt control power. The primary shall be connected to the line side of the motor starter; the secondary shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
8. Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock" and control wiring. In addition, it shall be possible to field-install one or more additional auxiliary contacts without removing existing wiring, or removing the starter from its enclosure.
9. Provide a 3-phase power monitor for each motor starter serving a motor of 20HP or greater. Monitor relay shall drop out upon loss of any phase, undervoltage on any or all phases, or phase reversal from A-B-C sequence. Relay shall be adjustable for trip range and shall automatically reset upon correction of trouble.
10. All motor starter enclosures shall be NEMA 1, general purpose enclosures, unless shown otherwise.

C. Combination Motor Starters:

1. Combination motor starters shall consist of an integrally mounted magnetic starter and a fusible disconnect switch in a heavy-duty type, dead front, sheet steel NEMA 1 (indoor) or NEMA 3R (outdoor), surface-mounted, general purpose enclosures. Size and number of poles shall be as required by equipment served. Combination motor starters shall be as specified for individual motor starters except as modified herein.

D. Disconnect Switch: Disconnect switch shall be as specified in "Safety and Disconnect Switches".

E. Unit Wiring: Unit shall be completely prewired to terminals to eliminate any interior field wiring except for connection of power supply conductors to switch line side terminals, motor leads to the starter load side terminals and control conductors to holding coil terminals.

F. Manual Motor Starters: Manual motor starters shall consist of an integral starter and a manual reset bimetallic trip type thermal overload elements protection in a common enclosure, surface-mounted. Size and number of poles shall be as shown and required by equipment served. Furnish pilot light as needed.

G. Manual motor starter with overload protection, 1 hp maximum, 115 or 230 volts, Square D #FG1-(l) Pole, FG2-(2) Pole; Square D #FG1P-(l) Pole, with pilot light, FG2P-(2) Pole, with pilot light.

H. All manual motor starter enclosures shall be NEMA 1 (for indoor) and NEMA 3R (for outdoor), general purpose enclosures, unless shown otherwise.

I. Manual motor starters to be flush in rooms with finished floors and walls. Provide a stainless steel cover.

2.2 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. Siemens Energy & Automation, Inc.
   c. Square D; a brand of Schneider Electric.
   d. General Electric

2. Configuration: Nonreversing.
3. Surface mounting.
4. Pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. Siemens Energy & Automation, Inc.
   c. Square D; a brand of Schneider Electric.
   d. General Electric

2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button bimetallic type.
4. Surface mounting.
5. Pilot light.

D. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. Siemens Energy & Automation, Inc.
   c. Square D; a brand of Schneider Electric.
   d. General Electric

2. Configuration: Nonreversing.

3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button bimetallic type.
4. Surface mounting.
5. Pilot light.

E. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. Siemens Energy & Automation, Inc.
   c. Square D; a brand of Schneider Electric.
   d. General Electric

2. Configuration: Nonreversing.
3. Contactor Coils: Pressure-encapsulated type.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 24-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
6. Melting Alloy Overload Relays:

   a. Inverse-time-current characteristic.
   b. Class 10 tripping characteristic.
   c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

7. Bimetallic Overload Relays:

   a. Inverse-time-current characteristic.
   b. Class 10 tripping characteristic.
   c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

8. Solid-State Overload Relay:

   a. Switch or dial selectable for motor running overload protection.
   b. Sensors in each phase.
   c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

9. External overload reset push button.

F. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. Siemens Energy & Automation, Inc.
   c. Square D; a brand of Schneider Electric.
   d. General Electric

2. Fusible Disconnecting Means:

   a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J fuses.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

3. Nonfusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
4. MCP Disconnecting Means:

    a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.

5. MCCB Disconnecting Means:

    a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
    b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
    c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.

2.3 MULTISPEED MAGNETIC CONTROLLERS

A. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    c. Rockwell Automation, Inc.; Allen-Bradley brand.
    d. Siemens Energy & Automation, Inc.
    e. Square D; a brand of Schneider Electric.

2. Configuration: Nonreversing.
3. Contactor Coils: Pressure-encapsulated type.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 24 -V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.

6. Compelling relays shall ensure that motor will start only at low speed.
7. Accelerating timer relays shall ensure properly timed acceleration through speeds lower than that selected.
8. Decelerating timer relays shall ensure automatically timed deceleration through each speed.
9. Antiplugging timer relays shall ensure a time delay when transferring from FORWARD to REVERSE and back.
10. Melting Alloy Overload Relays:

    a. Inverse-time-current characteristic.
    b. Class 10 tripping characteristic.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

11. Bimetallic Overload Relays:

    a. Inverse-time-current characteristic.
    b. Class 10 tripping characteristic.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

2.4 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R.
3. Kitchen, Wash-Down Areas: Type 4X.
4. Other Wet or Damp Indoor Locations: Type 4.

2.5 ACCESSORIES

A. Push Buttons, Pilot Lights, and Selector Switches: NEMA ICS 5; heavy-duty type; factory installed in controller enclosure cover unless otherwise indicated.

B. Control Relays: Auxiliary and adjustable time-delay relays.

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height, and with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

B. Install fuses in each fusible-switch enclosed controller.

C. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."

D. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

E. Comply with NECA 1.

F. Installation of Motor Starters.

1. Install motor starters where shown, in accordance with the manufacturer's written instructions, the applicable requirements of the NEC and NECA's "Standard of Installation", and recognized industry practices to ensure that products serve the intended function.

2. Install overload heaters in each motor starter. Heater ratings shall be based on actual motor nameplate full load amps.

3. Motor starters shall be provided to properly coordinate with motors as furnished by Division 23. Motor starter controls shall be provided to properly coordinate with controls specified in Division 23.

4. Provide all individual and combination motor starters with galvanized angle or other suitable supports where mounting on wall or other rigid surface is impractical. Starters shall not be supported by conduit alone. Where motor starters are mounted on equipment served, the switch shall not inhibit removal of any service panels or interfere with any required access areas. Manual motor starters shall be installed plumb and aligned in the plane of the wall in which they are installed.

G. Motors:

1. Motor Installation and Connections:

a. Motors associated with equipment furnished under other sections of the Specifications will be furnished and installed under the respective section. For such motors, the responsibility under the Electrical Section shall be to provide electrical service and to terminate same adjacent to the associated controller. This termination shall occur in a switch, fused switch, or motor circuit protector as required and/or as shown and noted on Drawings. Electrical service shall also be extended through the associated controller to the motor connector box in flexible conduit.
b. Furnish and install all power wiring and disconnect switches, starters, etc., required for all equipment specified under the "Controls" section of the Mechanical Specifications, whether or not specifically indicated on the Drawings. Circuits shall be run to nearest available 120/208 volt power or motor control panel.
c. Each motor shall be connected to a separate branch circuit except where shown otherwise. Unless otherwise indicated, circuits shall run to the motor via starting equipment and conduit to motors shall terminate in the conduit fittings on the motors, the

final connection being made with flexible conduit as hereinbefore specified. Ground bond or separate copper conductor shall be made from motor frame to rigid conduit system.

d. Should any equipment and/or motors be furnished requiring electrical service different from that indicated for the equipment and/or motor(s) specified, or electrical connections at more than one point, or at a point different from the one indicated on the Drawings, it will be the responsibility of the Contractor to make the required coordination and changes at no additional cost to the Owner. Refer to Division 23.

2. Motor Control Wiring: Complete motor control wiring shall be provided under the Mechanical Section of these Specifications.

3.2 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.3 CONTROL WIRING INSTALLATION

A. Bundle, train, and support wiring in enclosures.

B. Connect selector switches and other automatic-control selection devices where applicable.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Set field-adjustable switches and overload-relay pickup and trip ranges.

B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Architect before increasing settings.

C. Motor Starters:

1. Pre-Energization Check: Check motor starters for continuity of circuits and for short circuits.
2. Post Hook-Up Test: Subsequent to wire and cable hook-ups, energize motor starter and demonstrate satisfactory functioning.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers

END OF SECTION 26 2913

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 26 Section "Exterior Lighting" for exterior security lighting, roadway and parking lot lighting, poles, and standards.
2. Division 26 Section "Lighting Control Devices" for modular dimmers, programmable lighting control systems, time switches, photoelectric relays, occupancy sensors, power relays, and contactors.

1.2 DEFINITIONS

A. Emergency Lighting Unit: A fixture with integral emergency battery-powered supply and the means for controlling and charging the battery. It is also known as an emergency light set.

B. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads.

C. Average Life: The time after which 50 percent fails and 50 percent survives under normal conditions.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:

1. Outline drawings indicating dimensions and principal features of fixtures.

2. Electrical Ratings and Photometric Data: Certified results of independent laboratory tests for fixtures and lamps.
3. Battery and charger data for emergency lighting units.

C. Shop Drawings detailing nonstandard fixtures and indicating dimensions, weights, method of field assembly, components, features, and accessories.

D. Wiring diagrams detailing wiring for control system showing both factory-installed and field-installed wiring for specific system of this Project, and differentiating between factory-installed and field-installed wiring.

E. Maintenance data for fixtures to include in the operation and maintenance manual specified in Division 1.

1.4 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

B. Listing and Labeling: Provide fixtures, emergency lighting units, and accessory components specified in this Section that are listed and labeled for their indicated use and installation conditions on Project.

1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, underwater, and recessed in combustible construction that are specifically listed and labeled for such use. Provide fixtures for use in hazardous (classified) locations that are listed and labeled for the specific hazard.
2. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

C. Coordinate fixtures, mounting hardware, and trim with ceiling system and other items, including work of other trades, required to be mounted on ceiling or in ceiling space.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A Products: Subject to compliance with requirements, provide one of the products specified in each Interior Lighting Fixture Schedule shown on the drawings. Substitutions will not be permitted unless approved prior to bid date.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Lens Thickness: 0.125 inch (3 mm) minimum; except where greater thickness is indicated.

F Fluorescent Fixtures: Conform to UL 1570.

G Fluorescent Ballasts: Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.

1. Certification by Electrical Testing Laboratory (ETL).
2. Labeling by Certified Ballast Manufacturers Association (CBM).
3. Type: Class P, high power factor, except as otherwise indicated.
4. Sound Rating: "A" rating, except as otherwise indicated.
5. Voltage: Match connected circuits.
6. Lamp Flicker: Less than 5 percent.
7. Minimum Power Factor: 90 percent.
8. Total Harmonic Distortion (THD) of Ballast Current: Less than 10 percent.Total Harmonic Distortion (THD) of Ballast Current: Less than 10 percent.
9. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
10. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.
11. Multilamp Ballasts: Use 2, 3, or 4 lamp ballasts for multilamp fixtures where possible.
12. Lamp-ballast connection method does not reduce normal rated life of lamps.
13. Low-Temperature Fluorescent Ballasts: Where fixtures are installed outdoors all ballasts shall be capable of starting temperature of 0 deg F or colder.
14. Dimming Ballasts: Electronic type providing smooth dimming over a minimum range from 100 to 5 percent light output. Listed for use with specific fluorescent dimming system provided. Dimming systems are specified in Division 26 Section "Lighting Control Devices." Fluorescent wall dimmers are specified in Division 26 Section "Wiring Devices."

H. High-Intensity-Discharge (HID) Fixtures: Conform to UL 1572.

I. HID Ballasts: Conform to UL 1029 and ANSI C82.4. Include the following features, except as otherwise indicated.

1. Constant wattage autotransformer (CWA) or regulating high-power-factor type, unless otherwise indicated.
2. Operating Voltage: Match system voltage.
3. Single-Lamp Ballasts: Minimum starting temperature of minus 30 deg C.
4. Normal Ambient Operating Temperature: 40 deg C.
5. Open circuit operation will not reduce average life.

6. High-Pressure Sodium (HPS) Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.

J. Auxiliary, Instant-On, Quartz System: Automatically switches quartz lamp when fixture is initially energized and when momentary power outages occur. Turns quartz lamp off automatically when HID lamp reaches approximately 60 percent light output.

K. Incandescent Fixtures: Conform to UL 1571.

L. Track-Lighting Systems: Conform to UL 1574. Provide components, including track, fittings, and fixtures, from same manufacturer and as recommended by manufacturer for intended use.

M. Exit Signs: Conform to UL 924 and the following:

1. Sign Colors: Conform to local code.

2. Minimum Height of Letters: Conform to local code.

3. Arrows: Include as indicated.
4. Lamps for AC Operation: Light-emitting diodes (LED), 70,000 hours minimum rated life.

N. Self-Powered Exit Signs (Battery Type): Integral automatic high/low trickle charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.

O. Emergency Lighting Units: Conform to UL 924. Provide self-contained units with the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.

4. Time-Delay Relay: Provide time-delay relay in emergency lighting unit control circuit arranged to hold unit ON for fixed interval after restoration of power after an outage. Provide adequate time delay to permit HID lamps to restrike and develop adequate output.

P. Emergency Fluorescent Power Supply Unit: Conform to UL 924.

1. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body.

    a. Test Switch and LED Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
    b. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
    c. Charger: Fully automatic, solid-state, constant-current type.
    d. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Relay disconnects lamp and battery and automatically recharges when normal voltage is restored.

2. External Type: Self-contained, modular, battery-inverter unit.

    a. Test Switch and LED Indicator Light: Visible and accessible without entering ceiling space.
    b. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
    c. Charger: Fully automatic, solid-state, constant-current type.
    d. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Battery automatically recharges when normal voltage is restored.

Q. Vapor-tite light fixtures installed in elevator pits or exterior areas at mechanical equipment shall be Red Dot, catalog number VXWG-21-C. Fixture shall be lamped with 26 watt compact fluorescent screw-in type lamp.

2.3 LAMPS

A. Comply with ANSI C78 series that is applicable to each type of lamp.

B. Fluorescent Color Temperature and Minimum Color-Rendering Index (CRI): 3500 K and 85 CRI, except as otherwise indicated.

C. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid start circuits.

D. Metal Halide Color Temperature and Minimum Color-Rendering Index (CRI): 3600 K and 70 CRI, except as otherwise indicated.

2.4 FINISHES

A. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's written instructions and approved Shop Drawings. Support fixtures according to requirements of Division 26 Section "Common Work Results for Electrical."

B. Support for Recessed and Semirecessed Grid-Type Fluorescent Fixtures: Units may be supported from suspended ceiling support system. Install ceiling support system rods or wires at a minimum of 4 rods or wires for each fixture, located not more than 6 inches (150 mm) from fixture corners.

1. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corner.
2. Fixtures Smaller than Ceiling Grid: Install a minimum of 4 rods or wires for each fixture and locate at corner of ceiling grid where fixture is located. Do not support fixtures by ceiling acoustical panels.

C. Support for Suspended Fixtures: Brace pendants and rods over 48 inches (1200 mm) long to limit swinging. Support stem-mounted, single-unit, suspended fluorescent fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.

D. Air-Handling Fixtures: Install with dampers closed.

E. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.

3.2 CONNECTIONS

A. Ground lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replaced damaged fixtures and components.

B. Give advance notice of dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:

1. Duration of supply.
2. Low battery voltage shutdown.
3. Normal transfer to battery source and retransfer to normal.
4. Low supply voltage transfer.

E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

F. Report results of tests.

G. Replace fixtures that show evidence of corrosion during Project warranty period.

3.4 ADJUSTING AND CLEANING

A. Clean fixtures after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

3.5 INTERIOR LIGHTING FIXTURE SCHEDULE

A. See Schedule on Drawings.

END OF SECTION 26 5100

APPENDIX A

Geotechnical Exploration Report for Caesar Creek State Park Marina, 02/28/12

CTL Engineering Inc.
2860 Fisher Road, P.O. Box 44548, Columbus, Ohio 43204-3538
Phone: 614/276-8123 • Fax: 614/276-6377
e-mail: ctl@ctleng.com

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Consulting Engineers • Testing • Inspection Services • Analytical Laboratories

Established 1927

February 29, 2012

JJR
625 Williamson Street
Madison, WI 53703

Attention: Mr. Jason Stangland
Associate

Reference: Geotechnical Exploration
New Marina - Caesar Creek State Park
Waynesville, Ohio
CTL Project No. 11050228COL

Dear Mr. Stangland:

CTL Engineering, Inc. has completed the geotechnical exploration at the above referenced site. A copy of the report is being forwarded to you via email in pdf format.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office.

Respectfully Submitted

CTL ENGINEERING, INC.

Joe Grani, P.E.
Project Engineer

GEOTECHNICAL EXPLORATION

GEOTECHNICAL EXPLORATION
NEW MARINA-CAESAR CREEK STATE PARK
WAYNESVILLE, OHIO
CTL PROJECT NO. 11050228COL

PREPARED FOR:

JJR
625 WILLIAMSON STREET
MADISON, WI 53703

PREPARED BY:

CTL ENGINEERING, INC.
2860 FISHER ROAD
COLUMBUS, OHIO 43204
(614)-276-8123-Phone
(614)-276-6377-Fax

February 29, 2012

CTL ENGINEERING INC

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APPENDIX C BORING LOCATION PLAN/SOIL PROFILE SHEETS
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I. PROJECT LOCATION AND DESCRIPTION

The project involves the design of a new marina that will be constructed at Caesar Creek State Park in Waynesville, Ohio. At the time that this report was prepared, specific details about the proposed marina were not provided. However, it is understood that the bottom of the marina will be excavated down to approximate elevation 836. The docks will be supported onto piling extending into the underlying bedrock.

II. SUBSURFACE INVESTIGATION

Five (5) test borings, designated as B-1 through B-5, were drilled and cored at the approximate locations indicated on the appended Boring Location Plan. Borings B-1, B-2 and B-3 were drilled from a barge in the existing reservoir. Borings B-4 and B-5 were drilled on land.

The test borings were performed between January 31 and February 7, 2012, using a track mounted drill rig. Standard penetration tests were conducted in the test borings using a 140-pound hammer falling 30 inches to drive 2-inch O.D. split barrel samplers for 18 inches. Rock coring was performed in all borings using a double tube core barrel with a diamond bit.

Soil samples obtained from the drilling operation were preserved in glass jars, visually classified in the field and laboratory and tested for natural moisture content.

The rock from the coring operations was visually described in the field and laboratory and the Rock Quality Designation (RQD) and percent core recovery were determined. Representative samples of the shale were subjected to slake durability testing. None of the samples of the bedrock were of adequate length to perform compressive strength testing. The strength of the bedrock was described based on field parameters identified in Table 600.10 of The Ohio Department of Transportation Specifications for Geotechnical Explorations dated April 2010. A copy of this table is included in Appendix A.

The ground surface elevations at boring locations B-4 and B-5 were provided by WD Transportation. The water surface at the time of drilling borings B-1, B-2 and B-3 was provided by ODNR personnel as 846.65.

III. FINDINGS

Surface cover across the site consists mainly of dense brush with some trees. The ground surface generally slopes downward toward the Caesar Creek Lake, which is located southeast of the site. A Youth Fishing Pond is located west of the proposed marina site. Exposed bedrock was noted along the shoreline.

Boring B-4 exhibited 10 inches of topsoil at the surface. Boring B-5 drilled through and existing drive exhibited a pavement composition consisting of 4 inches of asphalt over 6 inches of granular base.

Below the surface cover, the borings exhibited soils described as either lean clay or fat clay extending down to the top of bedrock. The soils exhibited standard penetration values ranging from 4 to 27 blows per foot (bpf), with natural moisture content values ranging from 14 to 32 percent.

The recovered rock in borings B-1, B-2 and B-3 was described as limestone with interbedded clay layers. It is believed that the clay was formerly shale and has weathered to its current condition. The recovered rock from borings B-1, B-2 and B-3 exhibited RQD values ranging from 0 to 12 percent, and core recovery values ranging from 15 to 62 percent. In several of the core runs, much of the clay/shale washed away during coring operations.

Beneath the soil overburden, borings B-4 and B-5 exhibited bedrock described as shale or interbedded shale and limestone. The recovered rock from borings B-4 and B-5 exhibited RQD values ranging from 0 to 33 percent, with core recovery values ranging from 78 to 98 percent.

Representative samples of the recovered rock were subjected to slake durability testing. Results of the testing are appended to the report and are summarized below.

Boring No.	Core Run	Slake Durability Index (%)
B-4	CR-1	58.8
	CR-4	43.9
B-5	CR-1	68.2
	CR-2	67.4
	CR-5	52.5

No groundwater was noted during the soil sampling of borings B-4 and B-5.

IV. ANALYSIS AND RECOMMENDATIONS

The project involves the construction of a new marina. It is understood that the bottom of the marina will be excavated down to approximate elevation 836. The docks will be supported onto piling extending into the underlying bedrock.

A. Excavations

Excavations within the soil overburden at this site can be accomplished using standard excavation equipment.

Based upon the subsurface information obtained to date, it is believed that mass excavations in the weathered shale materials can be accomplished with high-powered equipment.

Excavation of the interbedded limestone layers will be difficult. The limestone has been visually described as slightly strong to strong per Table 600.10 of Ohio Department of Transportation Specifications for Geotechnical Explorations (included in Appendix A). The thickness of the interbedded limestone layers was generally in the range of about 4 to 8 inches.

Excavations within the weathered bedrock or bedrock in confined areas such as for utility trenches and building foundations will be difficult particularly where limestone is encountered. Saw cutting or other methods of rock removal will be needed when limestone or more competent shale is encountered in confined excavations.

Groundwater or seepage water should be expected within the underlying bedrock.

Temporary excavations in excess of 4.0 feet in depth, if required, should be sloped or shored according to OSHA regulations. Excavation sidewalls should be observed and approved by the Soils Engineer.

Permanently exposed cut slopes less than 20 feet in height may be laid back at a slope rate no steeper than those tabulated below.

Material Type	Allowable Slope Rate – Cut Slopes (H:V)
Soils	3:1
Shale Bedrock	1.5:1

B. Site Preparation

1. All vegetation and topsoil should be removed from the proposed construction limits. The topsoil may be stockpiled for landscaping purposes.

2. Subsequent to site clearing and excavation to the proposed grade, and prior to any fill placement, any exposed soils should be compacted and/or proofrolled in the presence of the Soils Engineer until a relatively unyielding surface is achieved. Soft soils, wherever encountered, should be disked, dried and recompacted, or otherwise improved as directed by the Soils Engineer.

3. During earthwork operations, care should be taken to provide adequate drainage on the surface of exposed soils. Absorption of heavy rainfall, accumulations of water and heavy construction traffic may result in softening of these soils, hence, severely weakening the strength

4. Fill material required to raise the grade on land may consist of silty-clayey soils, crushed limestone or sand and gravel. Topsoil and/or organically contaminated soils are not considered suitable for use as fill. All fill materials should be observed and approved by the Soils Engineer prior to placement.

5. The shale exhibited slake durability index values below 90. The shale is considered poor quality rock. This material will soften in the presence of water and is susceptible to scour especially when being used as a fill. The excavated limestone is more durable and is considered suitable for reuse

6. Engineered fill in areas of structures or pavements should be placed in layers not to exceed 8 inches in loose thickness, with each layer compacted to 100 percent of the maximum dry density as determined by ASTM D-698 standard method (AASHTO T-99), or as otherwise directed by the Soils Engineer.

7. Where new fill will be placed on or adjacent to existing slopes, slopes that are steeper than 8:1 Horizontal to Vertical (H:V) should be continuously benched over those areas. Benching should be of sufficient width to permit operations of placing and compacting equipment.

8. Permanently exposed soil embankment slopes should be constructed at a rate no steeper than 3:1 H:V. Permanently exposed soil slopes should be seeded and vegetation growth permitted to limit sloughing or surface erosion.

C. Dock Anchorage

The recommendations in this section assume that the soils and rock in the marina area will be excavated down to elevation ±836.

Due to the presence of limestone layers, driven piles would not achieve adequate embedment. Therefore, it is expected that the dock anchorage will consist of either drilled shafts or piles grouted in predrilled holes that extend into the underlying bedrock.

Rock coring should be expected within the limestone layers during installation of the foundation units.

The following parameters may be used along with the appended test boring records in the design of the dock anchorage.

Parameters	Material Type
	Bedrock
Total Unit Weight, pcf	140
Unconfined Compressive Strength, psi	500

V. CHANGED CONDITIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions using generally accepted geotechnical engineering practices. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates drilled, they are not necessarily representative of the subsurface conditions between boring locations or subsurface conditions during other seasons of the year.

In the event that changes in the project are proposed, additional information becomes available, or if it is apparent that subsurface conditions are different from those provided in this report, CTL Engineering should be notified so that our recommendations can modified, if required.

VI. TESTING AND OBSERVATION

During the design process, it is recommended that CTL Engineering work with the project designers to confirm that the geotechnical recommendations are properly incorporated into the final plans and specifications, and to assist with establishing criteria for the construction observation and testing.

CTL Engineering is not responsible for independent conclusions, opinions and recommendations made by others based on the data and recommendations provided in this report. It is recommended that CTL be retained to provide construction quality control services on this project. If CTL Engineering is not retained for these services, CTL shall assume no responsibility for compliance with the design concepts or recommendations provided.

VII. CLOSING

This report has been prepared for the exclusive use by the client only on this project. Our services have been performed in accordance with generally accepted Geotechnical Engineering principles and practices. No warranty is either expressed or implied.

This report addresses only the geotechnical aspects of this project and does not include any environmental issues.

Specific design and construction recommendations have been provided in this report. Therefore, the report should be used in its entirety.

Respectfully Submitted,

CTL ENGINEERING, INC.

Joe Grani, P.E.
Project Engineer

Roger Evans, P.E.
Project Engineer

CTL ENGINEERING

APPENDIX A

TEST BORING RECORDS

CTL ENGINEERING INC

SOIL DESCRIPTION

NON-COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOW COUNTS PER FOOT (BPF)
Very Loose	0 – 4
Loose	5 – 10
Medium Dense	11- 30
Dense	31 – 50
Very Dense	Over 50

COHESIVE SOIL DESCRIPTION	STANDARD PENETRATION BLOW COUNTS PER FOOT (BPF)
Very Soft	0 – 1
Soft	2 – 4
Medium Stiff	5 – 8
Stiff	9 – 15
Very Stiff	16 – 30
Hard	Over 30

GRADATION COMPONENT	SIZE
Boulders	Larger Than 8"
Cobbles	8" to 3"
Coarse Gravel	Passing 3" Retained on ¾"
Fine Gravel	Passing ¾", Retained on #10
Coarse Sand	Passing #10, Retained on #40
Fine Sand	Passing #40, Retained on #200
Silt	0.074mm (Passing #200) to 0.005mm
Clay	Smaller Than 0.005 mm

COMPONENT MODIFIERS	PERCENT BY WEIGHT
Trace of	0 – 1%
Traces of	2 – 10%
Little	11 – 20%
Some	21 – 35%
And	36 – 50%

NON-COHESIVE SOIL DESCRIPTION	MOISTURE TERMS	COHESIVE SOIL DESCRIPTION
Powdery	Dry	Powdery
Some Moisture	Damp	Below Plastic Limit
Damp to the Touch	Moist	Above Plastic, Below Liquid Limit
Free Water	Wet	Above Liquid Limit

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Table 600.10. Strength of Bedrock

Description	Field Parameters	Range of Unconfined Compressive Strength	
		psi (ksf)	MPa
Extremely Strong	Cannot be scratched by a knife or sharp pick. Chipping of hand specimens requires hard repeated blows of the geologist hammer.	Greater than 30,000 (> 4320)	Greater than 200
Very Strong	Cannot be scratched by a knife or sharp pick. Breaking of hand specimens requires hard repeated blows of the geologist hammer.	15,000 to 30,000 (2160 to 4320)	100 to 200
Strong	Can be scratched with a knife or pick only with difficulty. Requires hard hammer blows to detach hand specimen. Sharp and resistant edges are present on hand specimen.	7500 to 15,000 (1080 to 2160)	50 to 100
Moderately Strong	Can be scratched with a knife or pick. Grooves or gouges to ¼" (6mm) deep can be excavated by hand blows of a geologist's pick. Requires moderate hammer blows to detach hand specimen.	3600 to 7500 (520 to 1080)	25 to 50
Slightly Strong	Can be grooved or gouged 0.05 inch (2 mm) deep by firm pressure of a knife or pick point. Can be excavated in small chips to pieces about 1-inch (25 mm) maximum size by hard blows of the point of a geologist's pick.	1500 to 3600 (215 to 520)	10 to 25
Weak	Can be grooved or gouged readily by a knife or pick. Can be excavated in small fragments by moderate blows of a pick point. Small, thin pieces can be broken by finger pressure.	750 to 1500 (108 to 215)	5 to 10
Very Weak	Can be carved with a knife. Can be excavated readily with a point of a pick. Pieces 1 inch (25 mm) or more in thickness can be broken by finger pressure. Can be scratched by fingernail.	40 to 750 (6 to 108)	0.3 to 5

605.6 Texture

Describe the rock texture by the grain size of the parent material from which the rock is composed. Use the particle sizes in Table 600-11, which are based upon the American Geological Institute, to describe the rock texture:

TEST BORING RECORD

CLIENT : JJR
PROJECT : New Marina
LOCATION : Caesar Creek State Park
PROJECT NO. : 11050228COL

BORING NO.: B-1
SHEET 1 OF 2
DATE STARTED : 02-07-12
DATE COMPLETED : 02-07-12

BORING ELEVATION : 846.7 Feet	BORING METHOD : HSA-NQ	HAMMER : Auto
STATION :	RIG TYPE : CME 55	DRILLER : MF
OFFSET :	CASING DIA. : 3.25"	TEMPERATURE : 40°
DEPTH : 23.0 Feet	CORE SIZE : 13	WEATHER : Over Cast

GROUNDWATER:

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
	5	**WATER**											
	10												
835.7		Stiff, Olive Brown **FAT CLAY with SAND (CH)**, Moist	11.0	SS-1	3 5 5	10	56	21		4.0*			
833.7			13.0										
	15	**LIMESTONE, GRAY, MODERATELY WEATHERED, MODERATELY STRONG, FOSSILIFEROUS INTERBEDDED WITH SOFT GRAY TO OLIVE BROWN CLAY; (COMPLETELY WEATHERED SHALE)**		CR-1 RQD= 0%			15						
	20			CR-2 RQD=			60						

Continued on next page

GTL ENGINEERING
2860 Fisher Rd.
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377
Email: www.ctleng.com

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : JJR

BORING NO.: B-1

PROJECT : New Marina

SHEET 2 OF 2

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
				0%									
823.7		**LIMESTONE, GRAY, MODERATELY WEATHERED, MODERATELY STRONG, FOSSILIFEROUS INTERBEDDED WITH SOFT GRAY TO OLIVE BROWN CLAY; (COMPLETELY WEATHERED SHALE)**	23.0										
		BOTTOM OF BORING											
	25												
	30												
	35												
	40												
	45												

GTL ENGINEERING

2860 Fisher Rd.
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377
Email: www.ctleng.com

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MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : JJR
PROJECT : New Marina
LOCATION : Caesar Creek State Park
PROJECT NO. : 11050228COL

BORING NO.: B-2
SHEET 1 OF 2
DATE STARTED : 02-07-12
DATE COMPLETED : 02-07-12

BORING ELEVATION	: 846.7 Feet	BORING METHOD	: HSA-NQ	HAMMER	: Auto
STATION	:	RIG TYPE	: CME 55	DRILLER	: MF
OFFSET	:	CASING DIA.	: 3.25"	TEMPERATURE	: 40°
DEPTH	: 24.0 Feet	CORE SIZE	: 14	WEATHER	: Over Cast

GROUNDWATER:

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
	5	**WATER**											
	10												
835.7		Medium Stiff, Brown **LEAN CLAY with SAND (CL)**, Moist	11.0	SS-1	3 3 5	8	94	25		5.0*			
832.7			14.0	SS-2	50-5"		80	18		9.0*			
	15	**LIMESTONE, GRAY, MODERATELY WEATHERED, MODERATELY STRONG, THINLY BEDDED, FOSSILIFEROUS, INTERBEDDED WITH CLAY (COMPLETELY WEATHERED SHALE)**		CR-1 RQD= 0%			62						
	20												

Continued on next page

CTL ENGINEERING
2860 Fisher Rd.
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377
Email: www.ctleng.com

BORING METHOD
HSA - Hollow Stem Auger
SFA - Solid Flight Auger
RC - Rock Coring
MD - Mud Drilling
WD - Wash Drilling
HA - Hand Auger

SAMPLING METHOD
SS - Split Spoon Sample
ST - Shelby Tube Sample
CR - Rock Core Sample
BS - Bag Sample

ABBREVIATIONS
* - Hand Penetrometer
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
SPT - Standard Penetration Test

TEST BORING RECORD

CLIENT : JJR

BORING NO.: B-2

PROJECT : New Marina

SHEET 2 OF 2

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
				CR-2 RQD= 0%			20						
822.7		**LIMESTONE, GRAY, MODERATELY WEATHERED, MODERATELY STRONG, THINLY BEDDED, FOSSILIFEROUS, INTERBEDDED WITH CLAY (COMPLETELY WEATHERED SHALE)**	24.0										
		BOTTOM OF BORING											
	25												
	30												
	35												
	40												
	45												

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2860 Fisher Rd.
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377
Email: www.ctleng.com

BORING METHOD

HSA - Hollow Stem Auger
SFA - Solid Flight Auger
RC - Rock Coring
MD - Mud Drilling
WD - Wash Drilling
HA - Hand Auger

SAMPLING METHOD

SS - Split Spoon Sample
ST - Shelby Tube Sample
CR - Rock Core Sample
BS - Bag Sample

ABBREVIATIONS

* - Hand Penetrometer
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
SPT - Standard Penetration Test

TEST BORING RECORD

CLIENT	: JJR	BORING NO.:	B-3
PROJECT	: New Marina	SHEET	1 OF 2
LOCATION	: Caesar Creek State Park	DATE STARTED	: 02-07-12
PROJECT NO.	: 11050228COL	DATE COMPLETED	: 02-07-12

BORING	ELEVATION : 846.7 Feet	BORING METHOD	: HSA-NQ	HAMMER	: Auto
	STATION :	RIG TYPE	: CME 55	DRILLER	: MF
	OFFSET :	CASING DIA.	: 3.25"	TEMPERATURE	: 40°
	DEPTH : 37.0 Feet	CORE SIZE	:	WEATHER	: Over Cast

GROUNDWATER:

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
	5	**WATER**											
	10												
834.7			12.0										
		Soft, Olive Brown **LEAN CLAY with SAND (CL)**, Moist		SS-1	1 2 2	4	67	27		4.0*			
833.2			13.5										
	15			SS-2	2 3 3	6	56	32		4.0*			
		Medium Stiff to Very Stiff, Brown **FAT CLAY (CH)**, Moist		SS-3	3 5 9	14	78	29		6.0*			
				SS-4	5 6 9	15	83	28		8.0*			
				SS-5	6 7 11	18	56	29		8.0*			
826.7	20		20.0										
		Very Stiff to Stiff, Grayish Brown **LEAN CLAY**		SS-6A	7 9	20	94	31		2.5*			

Continued on next page

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2860 Fisher Rd.
Columbus, Ohio 43204
Telephone: 614-276-8123
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HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
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RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : JJR

PROJECT : New Marina

BORING NO.: B-3

SHEET 2 OF 2

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
		(CL), Moist		6B	11 7			20		6.0*			
				SS-7	7 7	14	50	20		7.0*			
		Very Stiff to Stiff, Grayish Brown **LEAN CLAY (CL)**, Moist											
	25												
820.7		**LIMESTONE, GRAY, SLIGHTLY WEATHERED, STRONG**	26.0	SS-8	50-2"								
819.7			27.0										
	30	**LIMESTONE, GRAY, MODERATELY WEATHERED, MODERATELY STRONG, THINLY BEDDED, FOSSILIFEROUS, INTERBEDDED WITH CLAY (COMPLETELY WEATHERED SHALE)**		CR-1 RQD= 0%			28						
	35			CR-2 RQD= 12%			58						
809.7		**BOTTOM OF BORING**	37.0										
	40												
	45												

CTL ENGINEERING

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Columbus, Ohio 43204
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BORING METHOD

- HSA - Hollow Stem Auger
- SFA - Solid Flight Auger
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- HA - Hand Auger

SAMPLING METHOD

- SS - Split Spoon Sample
- ST - Shelby Tube Sample
- CR - Rock Core Sample
- BS - Bag Sample

ABBREVIATIONS

- * - Hand Penetrometer
- LL - Liquid Limit
- PL - Plastic Limit
- PI - Plasticity Index
- SPT - Standard Penetration Test

TEST BORING RECORD

CLIENT : JJR
PROJECT : New Marina
LOCATION : Caesar Creek State Park
PROJECT NO. : 11050228COL

BORING NO.: B-4
SHEET 1 OF 2
DATE STARTED : 02-01-12
DATE COMPLETED : 02-01-12

BORING ELEVATION : 858.9 Feet	BORING METHOD : HSA-NQ	HAMMER : Auto
STATION :	RIG TYPE : CME 55	DRILLER : MF
OFFSET :	CASING DIA. : 3.25"	TEMPERATURE : 50°
DEPTH : 34.0 Feet	CORE SIZE : 9	WEATHER : Over Cast

GROUNDWATER:

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
858.1		**TOPSOIL (10")**	0.8										
857.4		Medium Stiff, Brown **LEAN CLAY with SAND (CL)**, Moist **(POSSIBLE FILL)**	1.5	SS-1A SS-1B	7 5 9	14	56	29 14					
		Medium Stiff, Grayish Brown **GRAVELLY LEAN CLAY with SAND (CL)**, Moist **(POSSIBLE FILL)**											
855.4			3.5										
	5	**SHALE, GRAY, HIGHLY WEATHERED, WEAK**		SS-2	29 28 41	69	56						
				SS-3	23 20 36	56	61						
849.9			9.0	SS-4	50-4"		75						
	10			CR-1 RQD= 15%			78						
	15	**INTERBEDDED SHALE AND LIMESTONE** **85% SHALE, GRAY, MODERATELY WEATHERED, WEAK TO VERY WEAK, VERY THINLY BEDDED** **15% LIMESTONE, GRAY, SLIGHTLY WEATHERED, MODERATELY STRONG, THINLY BEDDED, FOSSILIFEROUS**		CR-2 RQD= 10%			85						
	20												

Continued on next page

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2860 Fisher Rd.
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377
Email: www.ctleng.com

BORING METHOD
HSA - Hollow Stem Auger
SFA - Solid Flight Auger
RC - Rock Coring
MD - Mud Drilling
WD - Wash Drilling
HA - Hand Auger

SAMPLING METHOD
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CR - Rock Core Sample
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ABBREVIATIONS
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TEST BORING RECORD

CLIENT : JJR

PROJECT : New Marina

BORING NO.: **B-4**

SHEET 2 OF 2

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
				CR-3 RQD= 0%			92						
	25	**INTERBEDDED SHALE AND LIMESTONE**											
		85% SHALE, GRAY, MODERATELY WEATHERED, WEAK TO VERY WEAK, VERY THINLY BEDDED		CR-4 RQD= 18%			95						
		15% LIMESTONE, GRAY, SLIGHTLY WEATHERED, MODERATELY STRONG, THINLY BEDDED, FOSSILIFEROUS											
	30			CR-5 RQD= 18%			98						
824.9			34.0										
	35												
	40												
	45												

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ST - Shelby Tube Sample
CR - Rock Core Sample
BS - Bag Sample

ABBREVIATIONS

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LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
SPT - Standard Penetration Test

TEST BORING RECORD

CLIENT : JJR
PROJECT : New Marina
LOCATION : Caesar Creek State Park
PROJECT NO. : 11050228COL

BORING NO.: B-5
SHEET 1 OF 2
DATE STARTED : 01-31-12
DATE COMPLETED : 01-31-12

BORING ELEVATION	857.4 Feet	BORING METHOD	HSA-NQ	HAMMER	Auto
STATION		RIG TYPE	CME 55	DRILLER	MF
OFFSET		CASING DIA.	3.25"	TEMPERATURE	53°
DEPTH	33.0 Feet	CORE SIZE	4	WEATHER	Sunny

GROUNDWATER:

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
857.1		**ASPHALT (4")**	0.3										
856.6		**BASE COURSE (6")**	0.8										
		Very Stiff, Dark Brown **SANDY LEAN CLAY with GRAVEL (CL)**, Moist		SS-1	6 7 20	27	83	19					
854.4			3.0										
				SS-2	50-5"								
	5			CR-1 RQD= 0%			83						
	10	**INTERBEDDED SHALE AND LIMESTONE**											
		73% SHALE, GRAY, MODERATELY WEATHERED, WEAK TO VERY WEAK, VERY THIN BEDDED		CR-2 RQD= 0%			88						
		27% LIMESTONE, GRAY, SLIGHTLY TO MODERATELY WEATHERED, SLIGHTLY STRONG TO STRONG, THINLY BEDDED, FOSSILIFEROUS											
	15			CR-3 RQD= 7%			85						
	20												

Continued on next page

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BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : JJR

PROJECT : New Marina

BORING NO.: B-5

SHEET 2 OF 2

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 12" (N)	% RECOVERY	MOISTURE CONTENT	TOTAL UNIT WEIGHT, pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS LL	PL	PI
				CR-4 RQD= 20%			93						
	25	**INTERBEDDED SHALE AND LIMESTONE**											
		73% SHALE, GRAY, MODERATELY WEATHERED, WEAK TO VERY WEAK, VERY THIN BEDDED		CR-5 RQD= 33%			98						
		27% LIMESTONE, GRAY, SLIGHTLY TO MODERATELY WEATHERED, SLIGHTLY STRONG TO STRONG, THINLY BEDDED, FOSSILIFEROUS											
	30			CR-6 RQD= 30%			78						
824.4			33.0										
	35												
	40												
	45												

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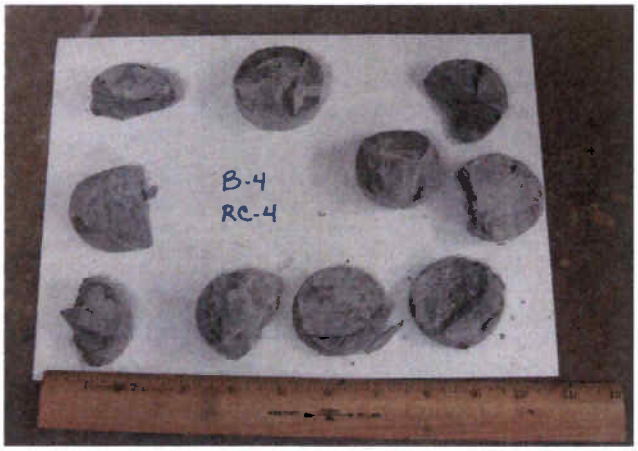
APPENDIX B
LABORATORY TEST RESULTS

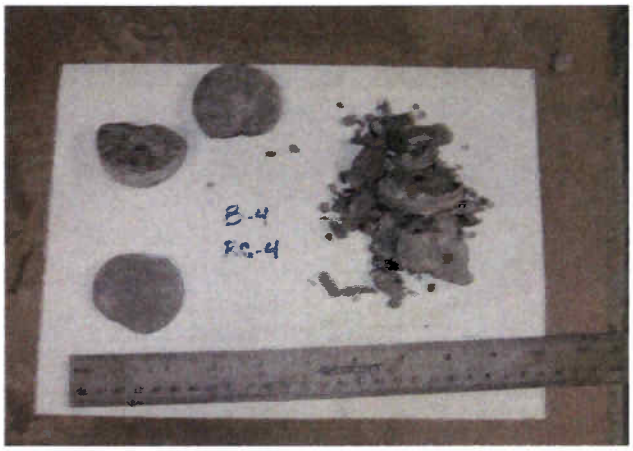
GTL ENGINEERING INC

Slake Durability of Shales and Similar Weak Rocks **ASTM D 4644-08**	**CTL ENGINEERING, INC.** 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-4, CR-4 Sample Description: Gray Shale Slake Durability Index (%): 43.9 (second cycle) Moisture Content (%): 5.0 Water Temperature (°C) range: 17.3 - 19.0 average: 18.2	Client: JJR Project: Caesar Creek State Park Location: Waynesville, OH Project No. 11050228COL Lab Project No. Date Tested: 2/7/12 to 2/13/12 Reviewed by: DM / JG

Sample Photographs



Pre-Test Sample



Post Test Sample

Remarks:

Post Test Specimen- Type II - Sample Consists of Large and Small Fragments

Slake Durability of Shales and Similar Weak Rocks **ASTM D 4644-08**	**CTL ENGINEERING, INC.** 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-4, CR-1 Sample Description: Gray Shale Slake Durability Index (%): 58.8 (second cycle) Moisture Content (%): 4.5 Water Temperature (°C) range: 17.4 - 18.6 average: 18.0	Client: JJR Project: Caesar Creek State Park Location: Waynesville, OH Project No. 11050228COL Lab Project No. Date Tested: 2/7/12 to 2/13/12 Reviewed by: DM / JG

Sample Photographs

Pre-Test Sample

Post Test Sample

Remarks:

Post Test Specimen- Type II - Sample Consists of Large and Small Fragments

Slake Durability of Shales and Similar Weak Rocks **ASTM D 4644-08**	**CTL ENGINEERING, INC.** 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-5, CR-1 Sample Description: Gray Shale Slake Durability Index (%): 68.2 (second cycle) Moisture Content (%): 7.8 Water Temperature (°C) range: 17.4 - 18.8 average: 18.2	Client: JJR Project: Caesar Creek State Park Location: Waynesville, OH Project No. 11050228COL Lab Project No. Date Tested: 2/7/12 to 2/13/12 Reviewed by: DM / JG

Sample Photographs

Pre-Test Sample

Post Test Sample

Remarks:

Post Test Specimen- Type II - Sample Consists of Large and Small Fragments

Slake Durability of Shales and Similar Weak Rocks **ASTM D 4644-08**	**CTL ENGINEERING, INC.** 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-5, CR-2 Sample Description: Gray Shale Slake Durability Index (%): 67.4 (second cycle) Moisture Content (%): 3.9 Water Temperature (°C) range: 17.4 - 18.6 average: 18.1	Client: JJR Project: Caesar Creek State Park Location: Waynesville, OH Project No. 11050228COL Lab Project No. Date Tested: 2/7/12 to 2/13/12 Reviewed by: DM / JG

Sample Photographs

Pre-Test Sample

Post Test Sample

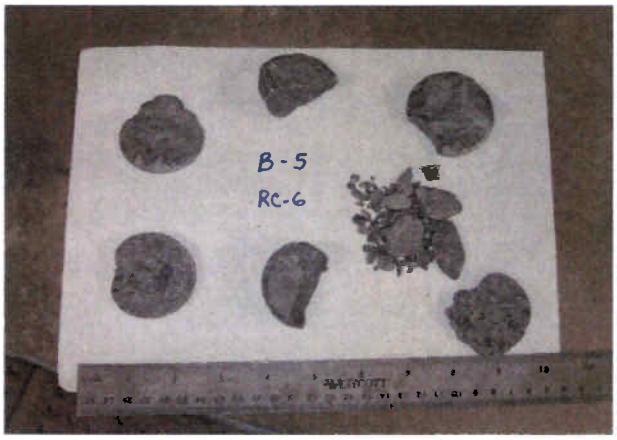
Remarks:

Post Test Specimen- Type II - Sample Consists of Large and Small Fragments

Slake Durability of Shales and Similar Weak Rocks **ASTM D 4644-08**	**CTL ENGINEERING, INC.** 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-5, CR-6 Sample Description: Gray Shale Slake Durability Index (%): 52.5 (second cycle) Moisture Content (%): 4.4 Water Temperature (°C) range: 17.8 - 18.7 average: 18.3	Client: JJR Project: Caesar Creek State Park Location: Waynesville, OH Project No. 11050228COL Lab Project No. Date Tested: 2/7/12 to 2/13/12 Reviewed by: DM / JG

Sample Photographs

Pre-Test Sample



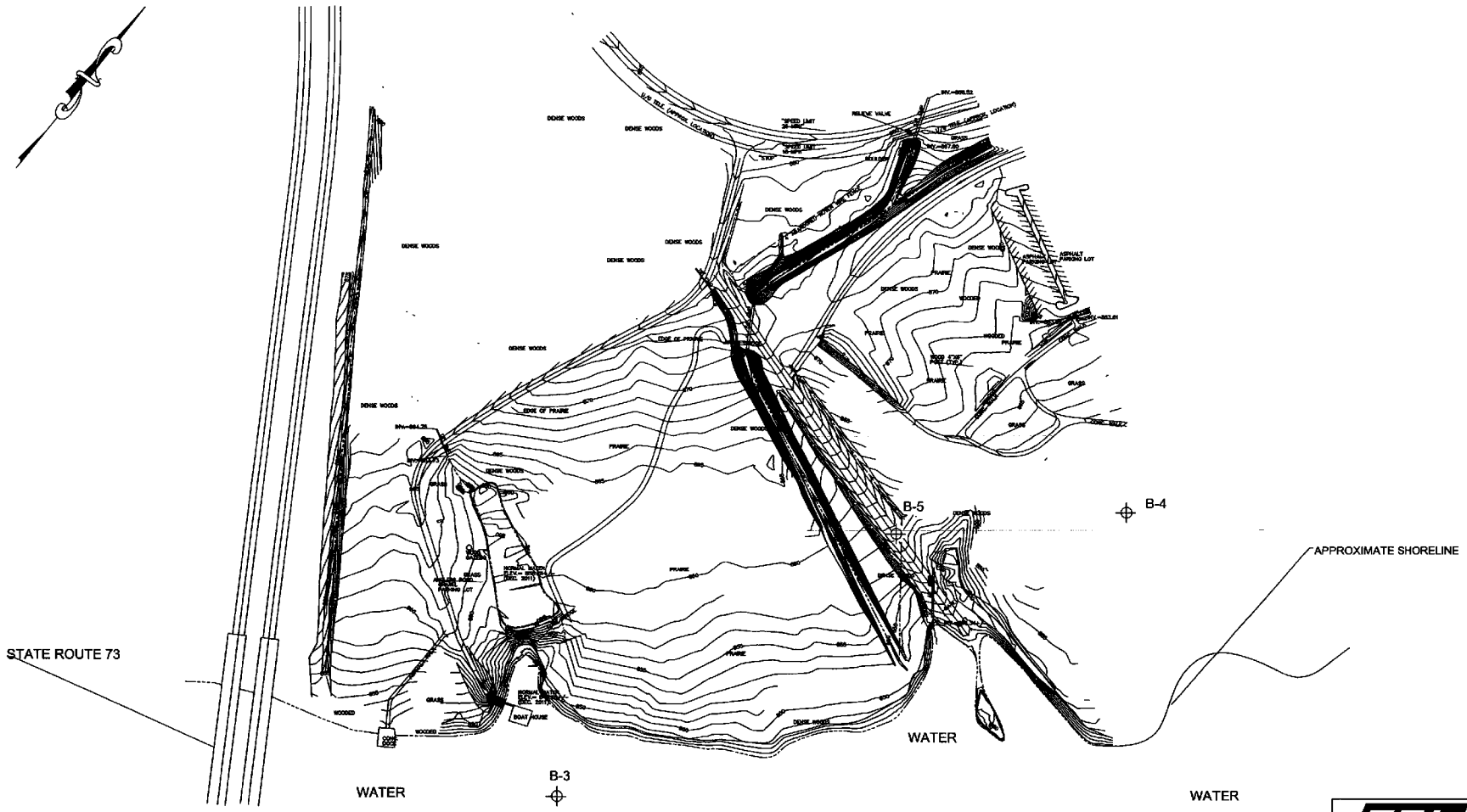
Post Test Sample

Remarks:

Post Test Specimen- Type II - Sample Consists of Large and Small Fragments

APPENDIX C
BORING LOCATION PLAN/SOIL PROFILE SHEETS

GTL ENGINEERING INC.



NOTE:

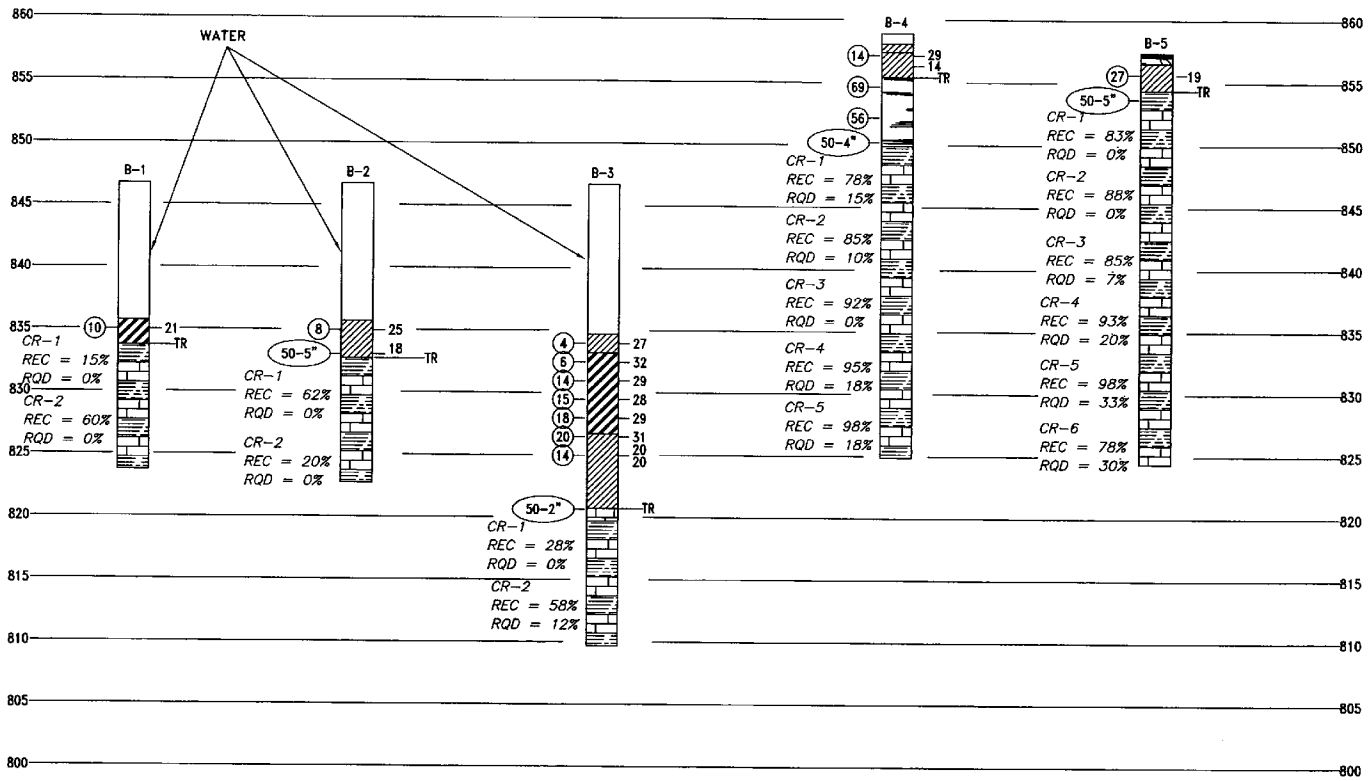
B-3 APPROXIMATE BORING LOCATION

CTL ENGINEERING INC.
CONSULTING ENGINEERS
TESTING + INSPECTION
LABORATORY SERVICES

BORING LOCATION PLAN

DATE	JJR INC. CAESAR CREEK STATE PARK NEW MARINA WAYNESVILLE, OHIO
02-23-12	
SCALE	
AS SHOWN	

DRAWN BY	REVIEWED BY	PAGE	PROJECT NO.
SM	RE	1 OF 2	11050228CDL



NOTE:

GROUND SURFACE ELEVATIONS AT THE TEST BORING LOCATIONS B-4 AND B-5 WERE PROVIDED BY WD TRANSPORTATION. THE WATER SURFACE ELEVATION AT THE TIME OF DRILLING OF B-1, B-2 AND B-3 WAS PROVIDED AS 846.65 FEET BY ODNR PERSONNEL.

LEGEND

TOPSOIL	GP	GC-GM	SW-SM	CL
ASPHALT	GM	GP-GC	SW-SC	CL-ML
CONCRETE	GC	SW	SP-SM	CH
BASE COURSE	GW-GM	SP	SC-SM	MH
FILL	GW-GC	SM	SP-SC	OH
GW	GP-GM	CH	ML	PT

SHALE

LIMESTONE

INTERBEDDED SHALE AND LIMESTONE

GROUND WATER DURING DRILLING

GROUND WATER AT COMPLETION OF DRILLING

—W MOISTURE CONTENT IN PERCENT (w)

(N)— STANDARD PENETRATION IN BLOWS PER FOOT (N)

——TR TOP OF BEDROCK

CTL ENGINEERING

CTL ENGINEERING INC.
CONSULTING ENGINEERS
TESTING * INSPECTION
LABORATORY SERVICES

SOIL PROFILE

DATE		
02-23-12		JIR INC. CAESAR CREEK STATE PARK NEW MARINA WAYNESVILLE, OHIO
SCALE		
AS SHOWN		
DRAWN BY	REVIEWED BY	PAGE	PROJECT NO.
SM	DM	2 OF 2	11050228COL

APPENDIX D
ROCK CORE PHOTOS

CTL ENGINEERING INC

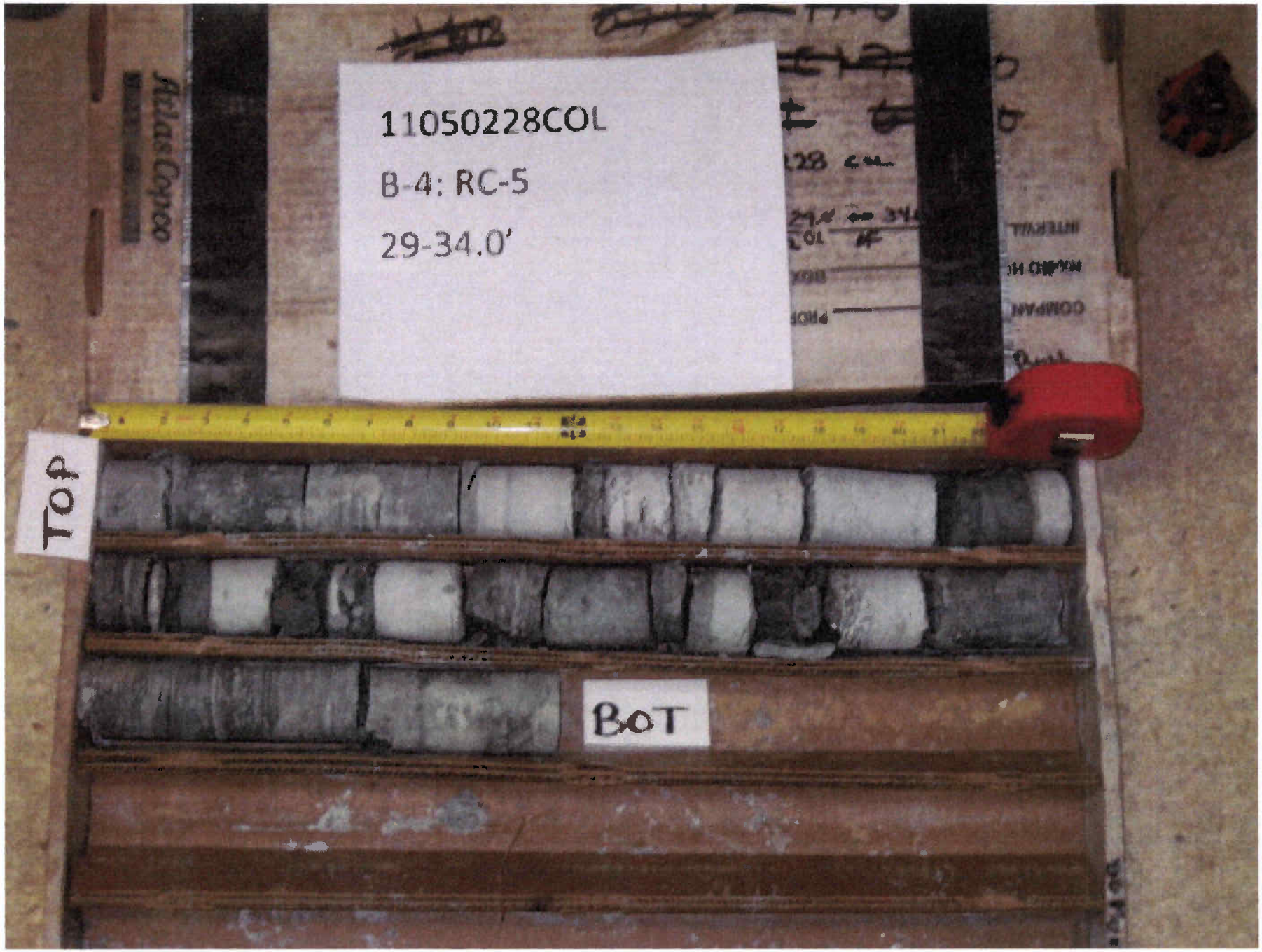
11050228COL
B-1, RC-1 & 2:
13-23.0'
TOP
BOT
TOP
BOT

11050228COL
B-2, RC-1 & 2:
14-24.0'
TOP
BOT

11050228COL
B-3, RC-1 & 2:
17-27.0'
TOP
BOT

11050228COL
B-4: RC-1 & 2
9-19.0'
BOART LONGYEAR
1-800-453-8749
TOP
BOT

11050228COL
B-4: RC-3 & 4
19-29.0'
TOP
BOT


11050228COL
B-4: RC-5
29-34.0'
TOP
BOT

11050228COL
B-5: RC-1 & 2
4-14.0'
TOP
BOT

11050228COL
B-5: RC-3 & 4
14-24.0'
TOP
BOT

11050228COL
B-5: RC-5 & 6
24-34.0'
TOP
BOT